PRE AND POSTOPERATIVE CARE
IN THE PEDIATRIC SURGICAL PATIENT

OPERATIVE CARE
SURGICAL PATIENT

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To
My Wife

Foreword

THERE have been remarkable advances in surgery in the past fifty years Without question these advances have been due to the elucidation of various physiologic changes occurring during the trauma of surgery The replacement of blood the maintenance of electrolyte balances and skillful anesthesia have made possible the performance of long and difficult operations Surgical technic has played a secondary role Indeed young surgeons today still follow the precepts of William Halsted, and vascular technics have varied little from the original teachings of Guthrie and Carrel The preparation of the whole patient for operation and the understanding of healing and convalescence with their complications have been the outstanding achievements

Thus this book, devoted to the pre and postoperative care of the pediatric surgical patient seems timely Dr Kiesewetter and his collaborators have provided an authoritative and usable reference for students residents and surgeons alike Only by anticipation of and preparation for any eventuality that may occur in the operating room, combined with alert and intelligent postoperative care can maximum safety and success be secured for the child who must have surgical therapy

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Preface

PATIENTS in the pediatric age group who undergo surgery are often looked on and treated as "little adults" For several years the editor has felt the need for a concise outline of pre and post operative care in the field of pediatric surgery and this manual is an attempt to fill such a gap It is written with the "occasional pediatric surgeon" in mind—the surgeon who infrequently is called on to handle the problems peculiar to children from birth onward Too often his technical skill is compromised by lack of familiarity with pre and postoperative management of the child s condition It is the purpose of this book to provide him with help in this situation basing the recommendations on the experience that necessarily accrues to a children s hospital where many cases of each type are seen rather than an occasional one The material contained herein constitutes the basic care policies employed at the Children s Hospital of Pittsburgh since each of the contributors practices in this institution

This book is not a diagnostic handbook, per se, although some effort is made to guide the reader through the studies and differential considerations he may wish to employ No attempt is made to cover exhaustively the field of surgery in children We have tried to confine ourselves to those lesions seen with some frequency and only conditions where surgery is a part of the therapy are included

At the risk of being too brief we have employed an outline form so as to make the book a ready reference without the necessity for laborious reading through much verbal chaff to get the kernels of practical care We have tried to index and cross index

the work as completely as possible to facilitate the location of subjects

A word of appreciation is extended to each collaborator in this work, for the broad scope of its usefulness would not have been possible without their expert knowledge in specialized fields To their secretaries, and especially to my secretary, Mrs Jean Miller, go the editor s thanks for the technical assistance necessary to bring this book to the medical public

—W B K

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SECTION I GENERAL PREOPERATIVE CONSIDERATIONS

CHAPTER 1

The Child's Emotions and Surgery

EARL A LOOMIS JR

SINCE THE beginning of medicine, the humane surgeon has been sensitive to the sufferings of his patients—those sufferings caused by their illnesses and the sufferings occasioned by treatment The sensitivity of physicians to pain in their patients has led to the widespread use of anesthesia for painful procedures Pediatric surgeons are no less aware of both the immediate and the lasting effects of painful experiences on little children What is sometimes forgotten is the fact that children differ greatly in their sensitivity to pain from identical procedures and that anxiety and fear may be more important components to the child than pain itself Further injuries which illness and its subsequent treatment impose on children are separation from parents and familiar sights confrontation with new and sometimes frightening things and persons, and enforcement of a strange new regimen often consisting of bed rest an unfamiliar diet and a series of personal indignities In the course of our training as physicians we become accustomed to these hospital procedures and we may lose sight of the fact that for the young child, they may be strange, unnatural, and frightening

Since parents reactions to their children s illness and the attendant procedures are communicated to the children as symbolic of insecurity anxiety or uncertainty we are concerned not

only with a child and his illness, but also with the intricate, circular, and reverberating reactions of the equilibrium and disequilibrium of a family. We have, therefore, to consider not only the objective magnitude of the procedure—let us say a tonsillectomy, which is considered to be relatively a minor operation—but also its symbolic and personal meaning to the child and his family. Obviously a family who had lost a child some years previously through an operative procedure, particularly of the same kind, would be a much more anxious family, and their anxiety would be transmitted to the child in one way or another. For this reason it is important that the surgeon be as aware as possible of what a proposed step signifies to the child and to the family in question.

KINDS OF TRAUMA IMPOSED BY ILLNESS, HOSPITALIZATION, AND SURGERY

A. The pain and physical dysfunction entailed by the illness or surgery itself. This is frequently of sufficient intensity that a surgeon feels the additional temporary discomfort occasioned by his manipulations or procedures is not too high a price to pay for restoring the patient to health. The family concurs (and so would the author). However, we are desirous of reducing unnecessary trauma and of neutralizing the effects of trauma which cannot be avoided.

B. The enforced regression of hospitalization. By "regression" is meant the return to earlier stages of responsiveness and behavior. An example would be a child's impulse to go back to the bottle or the diaper. Regression is a common feature during and following illness. It is also sometimes imposed through the doctor's requirement that the child remain in bed, reclining or even immobile—occasionally, in fact, the latter state is enforced by a cast or other mechanical appliance. Such incidents as being forced to use a bed pan, having one's nakedness exposed (as if one were a baby), or being treated as a helpless, dependent, and submissive person are traumatic occurrences from the adult point of view. That these experiences are uncomfortable for children is sometimes forgotten, despite the fact that it may be frustrating to be deprived of a newly gained and hard-won developmental function and dignity. Not only does the enforced regression suggest a lowered

iating setback to a more "baby like" stage but it also represents a subtle encouragement to resume the earlier state

C *Results of trauma in the preschool child* The greatest single trauma to children of preschool age is probably that of separation from the mother or mother-equivalent. Fathers become more important later—through their indirect support to the mother Studies show that even brief separations for a child accustomed to being with his own mother almost exclusively can have great temporary and sometimes lasting effects in terms of health personality development and future neurotic and psychosomatic disorders Most institutions are becoming more aware of the real hazard in the separation of a child from its parent and are instituting the provision of a substitute parent who can be a constant nurse-companion during this period This person should handle the major contacts and attempt to establish a sufficient degree of mother child equivalence in order that the severe outcomes of *hospitalism* or *anaclitic depression* may be avoided or diminished

D *Mutilation anxiety* While the purpose of surgery is the restoration of function and tissue continuity to the child hospital and surgical procedures represent a threat of injury organ removal, and even death The degree of fear is not logically related to the magnitude of the procedure or the importance of the organ, but is frequently *displaced* to concern about other organs and parts This tendency is further accentuated when fantasied displacement actually occurs—e g when a child expects the performance of one procedure and discovers that another has been substituted for or added to the original operation The classic example is the anecdote of the brother and sister who were admitted for tonsillectomies the brother being rolled into the operating room first While the boy was under anesthesia the surgeon performed a "free" circumcision. On his way out of the operating room the awakening boy replied to his sister's inquiry "No it wasn't so bad—but you'll be surprised when you find out where your tonsils are" Such fantasies may well be perpetuated by an insistence upon removing children's underpants just as they go to surgery

Literal assault upon the genital organs is not required to produce fear of genital injury in a child who is at a stage of development when this is a prime concern (and this is true of most

children under 7, particularly boys from 4 to 7) Frequently the organ system likely to be traumatized psychologically by the operation is not the system on which the surgery is performed, but the one whose development is psychologically most crucial at the time of surgical intervention

Thus, procedures in the first year of life would be most likely to cause oral trauma with attendant possible damage to the physiologic and psychologic intake apparatus, procedures in the second and third years would more likely be focused around the anal, muscular, and speech apparatus, control of which is a predominant challenge, and procedures in the fourth to seventh years are most likely to be referred to the genital area, frequently construed as punishment for masturbation, masturbation fantasies, or sexual curiosity and exploration Other sexual fantasies may include the child's fear that his or her sex will be reversed

2 *Fear of anesthesia* For a child who has recently developed body control, the prospect of being narcotized or put to sleep is a threatening one Fantasies of passive submission to external assault are frequent and are often accompanied by fear of being incontinent The actual process of having a mask put on is frightening especially if it has been described as a pleasant procedure of smelling "sweet air"—which it emphatically is not This encourages the more realistic procedure of explaining to the child *in terms he can understand* exactly what is going to happen to him and, if possible, acquainting him in advance with the persons and equipment involved This first encounter may be frightening, and it may even increase the degree of resistance the child manifests to the procedure We have grown to believe that it is a more healthful response for the child to react as directly as possible to the "injury" or "assault" than for him to be oppressed or overwhelmed by the *unexpected* Although temporarily disturbed he may experience a lesser reaction and have slighter reason for the acquisition of a distorted personality

3 *Pregnancy fantasies* Little girls (and even little boys) may associate going to the hospital with having babies and expect that this will be the outcome of their admission One child of nearly 5 who had been admitted with a ruptured appendix, ten days after the birth of her fourth sibling said postoperatively, pointing to her [illegible] "My mommie [illegible] My mommie [illegible]

REACTIONS OF THE CHILD TYPES OF RESPONSE PATTERNS

A Hyperconformity Many children respond to surgery with stoicism cheerfulness, and inappropriate lack of concern While apparently undisturbed by the situation they may conceal latent trauma, the appropriate reaction being hidden by fear or guilt The child frequently denies that he feels alone and frightened or that he has suffered injury or removal of a body part One 1 year old admitted for excision of supernumerary digits insisted post operatively that the doctor didn t cut He only put on a band age and the extra parts came off

B Withdrawal and depression This reaction more common in longer term separations of child from parents is most signifi cant when the hospitalization occurs in the first year of life René Spitz describes two major reaction patterns to early separa tion *hospitalism* in children who have never had the chance to form intense, warm intimate relations with a mother figure due to institutionalization or hospitalization, and *anaclitic depression* in children who grieve after separation which interrupts but does not replace an adequate relationship Either condition has been known to lead to severe and often irreversible physiologic, intel lectual social and emotional damage

C Anxiety agitation and aggressive behavior Anxiety agita tion and aggressive behavior may be direct and appropriate re sponses to an unusual and frightening situation. An amount pro- portional to the degree of stress *for the particular child* is to be expected and its absence should cause concern A disproportion ate degree of anxiety is however indicative of either inordinate current stress or a sensitizing factor in the previous experiences of the child. Prugh and his colleagues found in many instances that even preoperative psychiatric *consultations* tended to reduce the degree of agitation and reaction to stress Florence Erickson s preliminary observations also confirm the impression that a simple discussion of the impending procedure may make a big difference in the child s reactions

D Delayed responses We are still unable fully to assess the incidence or importance of delayed reactions to surgical trauma in infancy and childhood. It is the consensus that they may repre sent extremely serious reactions Naturally they are the hardest to

recognize, assess, and follow up, since they appear long after the situation has become confused by intervening experiences

Neuroses, psychoses, and character disorders usually refer back to infantile and childhood experiences which the child was unable to master at the time and which, therefore, appear later as "inner saboteurs" Their prevention is linked with having provided the child the maximum of mastery skills and adequacies prior to surgery, and the minimum of trauma during hospitalization

MANAGEMENT, INCLUDING PROPHYLAXIS AND TREATMENT

A Preparation The surgeon and his staff should know as much as possible about what the operation will mean to the child and his family at this particular time A few minutes in attentive listening to parental reactions of anxiety, puzzlement, or concern can pay rich dividends in perception regarding the family's ability to prepare and support the child emotionally

It is desirable to face facts honestly and to tell in accurate detail, and in language understandable to the listener, just what is to be done and what the consequences may entail This information may be passed on to the patient and siblings in words and (especially in the case of the infant) in attitudes of calmness and freedom from apprehension The doctor's own ability to face the painful responsibility of sharing an unpleasant fact can reinforce the parents' resolve to be equally honest and courageous in telling the child what lies ahead and supporting him in his reaction

If time permits, the child will probably benefit from accepting and understanding the preparation little by little On the other hand preparation too far in advance may cause worry reactions in anxious children

Staff assurance and co-operation the avoidance of confusion and contradiction, of anxiety filled hours waiting for procedures which eventually are canceled or delayed the protection of the child from disconcerting half revelations through inadvertent bedside remarks all these add up to obvious but often neglected steps in making surgery easier for the child Providing privacy for operative procedures protects at least two children the one undergoing treatment and the anxious listener or [illegible]

server who may identify himself with the victim and think his turn is next The recognition of the fact that what we do to and for children (albeit in their interest) may be painful and frightening and to them *punishing* will make easier our acceptance of their natural reactive hostility

Certain parents should be advised to avoid the hospital atmosphere as much as possible Others can make a real contribution through sharing in the child's care and being present often and for fairly long periods especially if they can be spared at home Even in these cases there are probably times when the parent should be excused—for example during painful procedures Otherwise the child may regard the parent as either a cause of his pain or a helpless, frightened onlooker

A preschool child's reactions of clinging to the mother or rejecting her are not *necessarily* signs that he is better off without her visiting The fact that a child cries more when his mother is present and less when she is away may indicate that he has entered what Bowlby terms the phase of despair in her absence versus the phase of protest in her presence Besides showing these acute responses children may manifest more lasting changes in their attitudes toward their parents during and after hospitalization If a child especially a preschooler must be separated from his mother for long (more than from three to seven days) a mother substitute—acceptable to him—should be provided in the hospital

B Picking up the pieces There are advantages to the child's talking it out and playing it out if time and circumstances permit both before and after surgery Mastery by active reversal of role is one of the commonest spontaneous play technics a child will seize on. Hence in play the child will give the doctor or nurse doll the injection the enema, and the pills This may help him to accept his own enforced submission to their procedures with less lasting damage and with present confidence

Awareness of the implications—many yet unassessed—of what we do for and to the child should lead us to support investigatory work and to study existing experiments such as those of Bowlby Jessner and Prugh. Their work suggests that we be more attentive to both the chronologic and the emotional age the previous adaptive capacity of the child the special personal meaning of

our procedures to the child, the extent of his happy emotional balance with his family, and the fact that *the same stresses* may be interpreted by different children in a number of different ways

The prepared and informed surgeon will not be surprised at the outcome of various emergency procedures which did not lend themselves to preparation He will not feel to blame for unfortunate children whose preoperative emotional state made otherwise adequate preparation ineffective He will feel free to utilize the advice and help of child psychiatrists before and after surgery when indicated by special sensitivities or unusual postoperative reactions He will be aware of danger signals and will utilize his nurses and social workers, as well as his own contacts with the family, in alleviating situations which, minor as they may seem, upset a family equilibrium These circumstances confirm the fact that the operation is often more major than it would at first appear to be The surgeon is encouraged to develop sensitivities to the *larger surgical field,* which includes the emotional development and state of the child within his total family context

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CHAPTER 2

Fluid and Electrolyte Balance

FLUID THERAPY OF THE SURGICAL PATIENT USE OF WATER, ELECTROLYTES, COLLOIDS, CARBOHYDRATES, AMINO ACIDS, AND LIPIDS

T S DANOWSKI

THE STUDIES of Moore and Ball and of others (1, 2, 3, 6, 15, 16, 19, 20, 26) on the metabolic aspects of surgery have revealed that in the uncomplicated postoperative period there occur (1) a transient rise in temperature and in pulse rate, (2) a loss of body weight and of body fat, (3) a decreased excretion of sodium, chloride, and water, and (4) an increased output of potassium and nitrogen

Talbot, Crawford, and Butler (22) have emphasized that preoperative medication, anesthesia, and surgery restrict the scope of the homeostatic regulating mechanisms of the body, and that fluid prescriptions must be varied accordingly Both views have been incorporated as necessary in the outline of fluid therapy which follows

The object in fluid therapy should be the maintenance of an internal environment resembling that present in healthful conditions If disease has produced extensive disturbances, it is well to remember that replacement and repair need not be achieved within a few hours In fact, such rapid return to the so called

normal range may at times prove as harmful as the original derangement. It is often sufficient to remove the inciting agent and to start the patient toward recovery. In all surgical patients it is advisable to obtain an accurate daily measurement of the body weight and to maintain precise intake and output records. Whenever possible, drainage or related effluvia should be saved for measurement and analysis, for only in this way can the surgeon make an intelligent assessment of the patient's status and his requirements.

SHORT TERM MAINTENANCE THERAPY

A PROBLEM

Patients without significant pre-, intra, or postoperative deficits who require maintenance fluids for a few days only.

B SPECIFIC NEEDS

Replacement of water losses in urine via the insensible route, and provision of calories to minimize losses of body protein.

C PRESCRIPTION

Aqueous solutions of glucose (10 per cent) or glucose and fructose (10 per cent invert sugar) in volumes in keeping with

TABLE 1.—HOMEOSTATIC LIMITS IN PARENTERAL FLUID THERAPY*

	"Floor"	"Ceiling"
Glucose	75 Gm./sq.m./24 hrs	350 Gm./sq.m./24 hrs.
Sodium	10 mEq./sq.m./24 hrs.	225 mEq./sq.m./24 hrs
Chloride	10 mEq./sq.m./24 hrs	225 mEq./sq.m./24 hrs
Potassium	10 mEq./sq.m./24 hrs	225 mEq./sq.m./24 hrs
Phosphorus	0.3 Gm./sq.m./24 hrs	2.0 Gm./sq.m./24 hrs
Water	0.7 cc./m.osm. solute	10.0 cc./m.osm. solute
Water	900 cc./sq.m./24 hrs	2700 cc./sq.m./24 hrs

*From Talbot *et al* (22)

the "floor-ceiling" values devised by Talbot *et al* (22) (Table 1). The use of the body surface area as a reference standard permits accurate prescriptions for all age groups. A simplified table for estimating surface area from body weight can be used (23), though a more detailed nomogram is available (21) (Table 2).

D COMMENT

In the immediate postoperative period the ceiling values are constricted, and hence 1500 rather than 2700 ml/sq m /24 hours should be used in estimating safe fluid volumes Salt (NaCl) is not necessary since renal losses will decrease to zero as the conservation response sets in The use of fructose

TABLE 2

Body Weight, Kg	Body Weight, Lbs	Surface Area
1	2 2	10
2	4 4	15
3	6 6	20
4	8 8	25
5	11 0	29
6	13 2	33
7	15 4	38
8	17 6	42
9	19 8	45
10	22 0	49
15	33 0	64
20	44 0	82
25	55 0	95
30	66 0	1 11
35	77 0	1 23
40	88 0	1 34

or invert sugar minimizes urinary losses of carbohydrate and facilitates liver glycogenation All fluids should be given in the course of 24 hours or in divided portions every 8 hours

PROLONGED MAINTENANCE THERAPY

A PROBLEM

Maintenance of surgical patients on parenteral fluids for pro longed period

B SPECIFIC NEEDS

Water, calories nitrogen, electrolytes

C PRESCRIPTION

Water and carbohydrate in accordance with minimum and maximum values listed in Table 1 amino acids (protein hydrolysate) at a level of 3 Gm of protein per kg of body weight sodium, chloride potassium and phosphate as indicated in

TABLE 3—SAMPLE MULTIPLE ELECTROLYTE SOLUTION*

Na	40	mEq/L of 5% glucose
K	35 5	"
Cl	40	"
Lactate	20	"
Phosphate	15 5	"

* From Talbot et al (22)

Table 1 The need for water carbohydrate and these electrolytes can be met effectively by using hypotonic solutions of the type described by Butler (4 5) Darrow (10 11) or Talbot (22) and their colleagues (Table 3)

D COMMENT

Maintenance on nonelectrolyte solutions results in deficits of potassium, phosphate magnesium, and other body constituents since only renal conservation of sodium and chloride appears to be completely effective in illness whereas the other electrolytes continue to be lost despite a growing need Carbohydrate only minimizes negative balances of nitrogen whereas protein or amino acids can cancel them The use of hydrolysate or other protein derivatives should be restricted however to the end of the day since they produce a feeling of surfeit or anorexia, nausea, and vomiting and interfere with resumption of oral intake.

Intravenous lipids have been used experimentally (24 25) as a source of calories but thus far the problem of infusion reactions (fever back pain) has not been solved

Obviously in any patient deprived of oral intake for a prolonged period water and fat soluble vitamins should be included in the maintenance regimen (Table 4)

TABLE 4.—MAINTENANCE VITAMIN REQUIREMENTS

Vitamin A	5000 IU
Vitamin B	
Thiamin	1 mg
Riboflavin	2 mg
Nicotinic acid	10 mg
Vitamin C (ascorbic acid)	60 mg
Vitamin D	400-800 IU

COMBINED REPLACEMENT-MAINTENANCE THERAPY

A PROBLEM

Patients with deficits as a result of unreplaced losses of water and electrolytes, such as in diarrhea, vomiting, gastrointestinal drainage, ileostomy, pancreatic fistula, sweat, transudates, and exudates

B SPECIFIC NEEDS

Interruption of losses, if feasible, and replacement of deficits prior to surgery in addition to daily maintenance provision, principles are the same if deficits develop during complications following surgery

C PRESCRIPTION

Withhold oral intake in vomiting and in diarrheal patients or interrupt losses in whatever way possible Continue careful measurement of body weight and of intake and output, and measure NPN or BUN to establish status of renal function Obtain analyses of serum content of CO_2, chloride, sodium potassium, albumin, and globulin at daily intervals Analyze drainage or other effluvia for content of chief electrolytes or estimate concentrations from available tables (13) Evaluate the patient as a whole is the circulation adequate, is oxygen transport effective, is the patient anemic? Prescribe fluids in accordance with the results suggested

1 In pyloric stenosis or related disorder, CO_2 is high and chloride is low Though deficits of sodium and potassium are

present serum levels may not be changed NPN is often elevated indicating some measure of renal failure

TREATMENT Withhold oral intake Administer NaCl and KCl as hypotonic solutions in 5 per cent glucose in accordance with Table 1 (see Appendix for example) (22) or as more concentrated solutions (8 9 18) Patient is ready for surgery when return of CO chloride NPN toward or to normal values is definite

2 *Following profuse gastric drainage or after excessive gastric lavage* with 5 per cent glucose CO_2 is high and sodium and chloride are both low NPN is elevated drainage contains large amounts of sodium chloride and patient may be in obvious circulatory collapse as a result of salt depletion (7 12 28)

TREATMENT Interrupt lavage if possible or shift to 0 9 per cent saline as lavage fluid Infuse plasma, blood dextran or other colloid solution (28) and replace deficits of sodium chloride as estimated from intake and output data and blood chemistry determinations (see Appendix for example)

3 *In patients with draining biliary or pancreatic fistulas* Measure volume by weighing sponges before and after use analysis of electrolyte content is also possible by eluting used sponges in known volume of distilled water Much less chloride is present and more bicarbonate than in gastric secretions sodium and potassium content is about the same though considerable variation exists Serum changes when deficits develop hyponatremia and lowered serum total CO_2 content with chloride little changed Potassium may be down

TREATMENT Stop drainage if not feasible replace in accordance with output data and provide an additional increment for cancellation of previously incurred deficits (see Appendix for example)

4 *In uncontrolled ileostomies* In contrast to gastric secretion chloride content is low Such patients develop deficits of sodium and an acidosis Circulatory collapse may appear

TREATMENT Estimate or analyze losses discontinue oral intake, and replace water sodium chloride and potassium within the framework indicated in Table 1 In patients with

extensive deficits dilute solutions such as those described in Table 3 may prove inadequate for replacement purposes (17), and more concentrated isotonic or even hypertonic solutions must be used (see Appendix for example)

5 *In paralytic ileus, peritonitis* Huge outpouring of fluid into the mesentery and into the intestine can produce pronounced deficits of body fluids without evidence of external losses An awareness of this possibility permits replacement This must be empiric since quantitation is not possible

6 *In burns and traumatized surfaces* This subject is discussed in detail in the chapter on Plastic surgery (p 228)

SUMMARY

A program of parenteral fluid therapy for maintenance and for replacement based on measurement or estimation of losses has been outlined The composition and volume of such parenteral fluids are obviously also determined by body size, hence, a body surface area reference standard is used The quantities of water and solutes administered per unit of surface area are based on the known physiologic needs in nondeficient patients (herein referred to as "floor values" in accord with Talbot's usage) The rate of administration and the total amounts of such fluid should not exceed the excretory and regulatory mechanism of the body, called "ceiling values" Renal disease, cardiac failure, hepatic failure, and disturbances of mechanisms regulating the volume and composition of body fluids necessitate special adjustments in parenteral fluid therapy which are beyond the scope of this outline This subject has been discussed by the author in detail elsewhere

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CHAPTER 3

Anesthesia

JOSEPH H MARCY

I PREANESTHETIC MEDICATION

THE IMPORTANCE of preanesthetic medication in infants and children cannot be overstated *It is unnecessary and except in rare instances inexcusable that children not receive the benefit of adequate medication before anesthesia and surgery*

PURPOSES OF PREANESTHETIC MEDICATION

1 *To allay fear and apprehension* The child s reaction to separation from parents, to the strange surroundings of the operating room, and to the induction of anesthesia is one of fear if not terror
2 *To minimize secretions* Because of the relatively small dimensions of the infant s or child s respiratory tract, even a small amount of secretion may produce airway obstruction and hypoxia. Ether and divinyl ether used so frequently in this age group, are notorious in their stimulation of respiratory tract secretions A dry patient is the *sine qua non* of the smooth and safe conduct of anesthesia.
3 *To control exhausting and excessively rapid respiratory rate* Unpremedicated children anesthetized with ether may develop alarmingly high respiratory rates which result in small tidal volume and respiratory minute volume If allowed to

continue, an excessively rapid rate may lead to exhaustion of the respiratory mechanism

4 *To facilitate anesthetization* Good preoperative medication will contribute to a smoother induction, will reduce the total amount of anesthetic administered, and will make it easier to maintain an even plane of anesthesia

5 *To obtund harmful reflexes* Belladonna derivatives will tend to block vagal reflexes on the circulation and respiration. Opiates in judicious dosage will obtund respiratory reflexes resulting from surgical stimulation and traction

DRUGS

1 *Atropine,* though widely used for its drying action, is less effective than scopolamine and has no sedative result It is the drug of choice, however, for outpatient anesthesia

2 *Scopolamine,* also used chiefly for its drying action, has several advantages over atropine
   (a) Dose for dose it is a better drying agent
   (b) It provides amnesia and sedation
   (c) It does not produce tachycardia to the extent effected by atropine
   (d) It stimulates respiration slightly and tends to oppose the respiratory depressant effect of opiates and barbiturates

3 *Barbiturates* Drugs of this group are the most commonly used and probably the safest of the hypnotics for children They are usually well tolerated, and in judicious dosage do not cause harmful respiratory depression Pentobarbital, for example, may be given
   (a) orally as capsule or elixir,
   (b) rectally as capsule or suppository,
   (c) intramuscularly or intravenously (nembutal sodium)
   (d) DOSAGE (1) Oral, may be estimated crudely as 2 mg per pound of body weight (2) Rectal, approximately 2 times oral (3) Intramuscularly or intravenously, 15 mg (0 3 cc) per year of age These suggested dosages are conservative, and may be increased if desired without harmful consequences

4 *Opiates* Notwithstanding the prejudices of many physicians, this group of drugs may be used to advantage in the medication of pediatric patients Doses however must be controlled carefully especially in small children and infants, to avoid undue respiratory depression

(a) DOSAGE (when used without additional barbiturate)

(1) Morphine 0 10 mg per pound of body weight in older children. Smaller children and infants should be given ¼ to ½ this amount (2) Demerol* 1 mg per pound of body weight

TABLE 1—PREOPERATIVE MEDICATION CHILDREN'S HOSPITAL OF PITTSBURGH*

		Apothecary (Gr.)			Metric (Mg.)		
Age	Wt./Lb.	Morph	Nemb.	Scop	Morph.	Nemb.	Scop
0-2 mo	7 10	1/480		1/800	0 125		0 075
2 3 "	10-12	1/320		1/800	0 2		0 075
3-4 "	12 14	1/240		1/600	0 3		0 1
4-7	14 16	1/144		1/600	0 4		0 1
7 11	16-19	1/112		1/600	0 5		0 1
11 18 "	19-24	1/96		1/400	0 6		0 15
18-24 "	24-27	1/72	1/4	1/400	0.8	15	0 15
2 3 yr	27 30	1/64	1/4	1/400	1 0	15	0 15
3-5 "	30-40	1/48	ss	1/300	1 5	30	0.2
5-8 "	40-55	1/32	ss	1/300	2.0	30	0 2
8-10 "	55-65	1/24	i	1/200	2 5	60	0 3
10-12 "	65-80	1/16	i	1/200	4 0	60	0 3
12 14 "	80-90	1/12	iss	1/200	5.0	90	0 3
Over 14	90 +	1/8	iss	1/200	8.0	90	0.3

Modified from Leigh and Belton: *Pediatric Anesthesia* (New York: The Macmillan Company 1948) With permission

5 *Combination of opiate barbiturate and scopolamine* One of the most satisfactory and workable systems of medication for pediatric patients is that described by Leigh and Belton Conservative, and therefore safe doses of both morphine and barbiturate are used in conjunction with scopolamine. This schedule of medication provides mild sedation without untoward respiratory depression and, usually light

sleep from which the child can be easily roused When indicated in apprehensive children and especially when the child has received one or more anesthetics previously the dosage of morphine and barbiturate may be safely increased (See Table 1)

6 *Chloral hydrate* is a safe and useful drug for pediatric as well as adult patients It may be given as a capsule (0 25 and 0 5 Gm.) or as a palatable orange flavored syrup (1 cc. = 100 mg) The syrup is usually diluted in 1 ounce of water

(a) DOSAGE 10 mg per lb of body weight

7 *Chlorpromazine* may be used to advantage as an adjunct to premedication by reason of its ability to intensify the effect of sedative drugs Its chief use in this field at present is in patients who are behavior problems those who are particularly apprehensive, and those who must undergo repeated surgical procedures.

(a) DOSAGE	1 2 years of age	10 15 mg
	2-6	25 mg
	6-12	50 mg

(b) *Time of administration* One half hour before premedication if given intramuscularly or one hour before medication if given orally

8 *Codeine* although it is an opiate, is listed separately to emphasize its small value in premedication It is included only to condemn its use

No drug or regimen of medication for children will be successful unless sufficient time is allowed for the full effect of the drugs to take place *At least 60 to 90 minutes must be allowed before the induction of anesthesia* Medication given just before induction does not benefit the child and may be doubly harmful since maximum depression will occur after anesthesia has begun

2. AGENTS

The armamentarium of anesthetic agents for pediatric patients is virtually the same as that for adults The emphasis on certain of these anesthetic substances is somewhat different, however

AGENTS FOR BASAL NARCOSIS

(See "Rectal" under Technics, p 50.)

1 *Tribromethanol (Avertin®)*
2 *Thiopental sodium (Pentothal® Sodium)*
3 *Thiamylal sodium (Surital® Sodium)*

AGENTS FOR INDUCTION

1 *Divinyl ether (Vinethene®)*
  (a) ADVANTAGES less irritating than ether, consciousness is lost fairly rapidly
  (b) DISADVANTAGES tends to promote salivary secretion, occasionally convulsions or co-ordinated involuntary "running movements" of the extremities occur, unpleasant odor
2 *Ethyl vinyl ether (Vinamar®)*
  Properties are approximately the same as those of divinyl ether
3 *Ethyl chloride*
  (a) ADVANTAGES loss of consciousness is rapid, odor is sweetish, not irritating
  (b) DISADVANTAGES because of potency, myocardial toxicity, and rapidity of action, this drug should not be used by the inexperienced
4 *Chloroform*
  (a) ADVANTAGES loss of consciousness is rapid; pleasant, sweetish odor, not irritating, nonexplosive
  (b) DISADVANTAGES potency and toxicity limit its use to those who have had experience with the drug
5 *Nitrous oxide*
  (a) ADVANTAGES nonirritating, nonexplosive
  (b) DISADVANTAGES relative lack of potency, must be used in high concentrations which predispose to hypoxia particularly in the very young
6 *Cyclopropane*
  (a) ADVANTAGES high potency, may be used with high concentration of oxygen, rapidity of onset of anesthesia, used to advantage with rebreathing technics where anesthetist may assist respirations during induction
  (b) DISADVANTAGES potency and toxicity in high concen

tration should limit its use to the experienced explosive

7 *Thiopental sodium and thiamylal sodium*

(a) ADVANTAGES rapid pleasant induction without use of face mask tends to protect against convulsions in acutely ill patients with elevated temperatures and/or acidosis

(b) DISADVANTAGES technical difficulty of venipuncture especially in small children venipuncture may be a more traumatic experience for the child than use of face mask tidal volume may be reduced and induction of volatile agents therefore retarded may increase laryngeal irritability if followed by ether especially if administered by open drop technic contraindicated in patients with histories of allergy or asthma.

AGENTS FOR MAINTENANCE OF ANESTHESIA

1 *Ethyl ether*

(a) ADVANTAGES wide margin of safety may be used in a variety of technics sufficient potency for all types of surgery does not depress respirations in average plane of surgical anesthesia.

(b) DISADVANTAGES postoperative nausea and vomiting unpleasant smell and aftertaste causes metabolic acidosis, especially in infants explosive, especially when administered with oxygen

2 *Cyclopropane*

(a) ADVANTAGES lower incidence of nausea and vomiting does not cause metabolic acidosis tolerated better than ether by the very young and the very ill

(b) DISADVANTAGES explosive potency and toxicity restrict its use to the experienced anesthetist

3 *Intravenous Thiopental sodium and Thiamylal sodium*

(a) ADVANTAGES relative ease of administration as in adult anesthesia, may be used to advantage in conjunction with nitrous oxide, with or without muscle relaxants nonexplosive minimal postoperative discomfort.

(b) DISADVANTAGES although it may be used with safety even in infants, relatively large doses may be required to provide adequate anesthesia prolonged reaction time will inevitably result from large total dosage.

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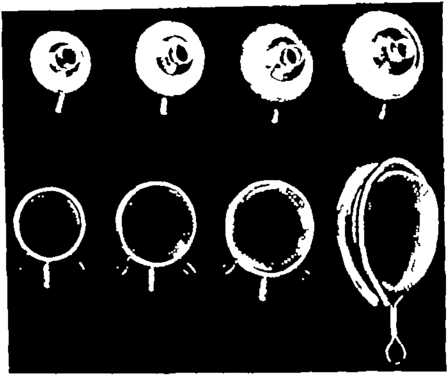

FIG. 1—*Above* four sizes of premature mask for to-and-fro technic. *Below* open drop masks

(d) sufficient open table surface on which to place records and equipment
(e) adequate drawer space to store equipment

MASK FOR OPEN DROP USE

1 In addition to the masks commonly used for older children and adults, smaller masks in a variety of sizes are desirable for infants Care must be taken to select masks which have the least possible dead space.

BAG AND MASK ASSEMBLIES

Used with or without *soda lime canisters*

1 These are required for to-and fro technics Such assemblies are also useful for emergency delivery of oxygen under positive pressure both in the operating room and on the ward

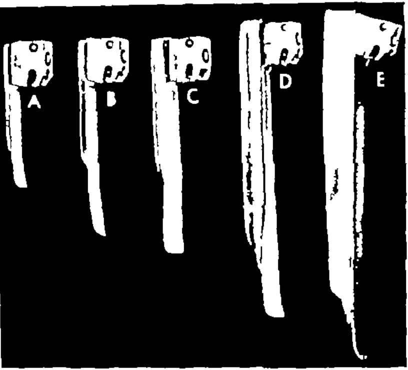

FIG. 3.—Laryngoscope blades. *A*, Miller blade, premature. *B*, Miller blade, infant. *C*, Flagg blade, child. *D*, Wis-Foregger blade, adult. *E*, Guedel blade, large adult.

ENDOTRACHEAL TUBES

1. These tubes are manufactured in natural and synthetic rubber, several types of plastic material, and latex rubber into which a metal spiral has been incorporated to prevent kinking. Tubes, regardless of material and alleged size, may vary appreciably from one to another in consistency, outside diameter, and wall thickness. Whenever possible, therefore, tubes should be selected and measured individually to avoid the excessively stiff or flimsy, and particularly tubes with unduly thick walls.
   (a) Tube sizes.
      1. Many types of tubes now available come in even-numbered "French" sizes. In the United States, "French" refers to the circumference of the tube in

FIG 4 —Endotracheal tubes *Above,* No 32 F (adult) plastic tube *Below,* No 13 F (newborn) plastic tube

TABLE 2 —SCALE FOR MAGILL NATURAL RUBBER TUBES WITH APPROXIMATELY EQUIVALENT "FRENCH" VALUES

#00 - 13 French	# 3 - 24 French	# 7 - 31 French
# 0 - 16 "	# 4 - 25 "	# 8 - 33 "
# 1 - 19 "	# 5 - 27 "	# 9 - 36
# 2 - 21 "	# 6 - 29 "	#10 - 38

TABLE 3 —SCALE FOR MAGILL "PORTEX" TUBES WITH APPROXIMATELY EQUIVALENT "FRENCH" VALUES

# 0 - 13 French	# 4 - 25 French	# 8 - 35 French
# 1 - 15 "	# 5 - 27 "	# 9 - 36 "
# 2 - 19	# 6 - 29	#9H - 38 "
# 3 - 21 "	# 7 - 31 "	#10 - 40

Also available Intermediate sizes #1A, #2A, and #2B

TABLE 4 —THE DAVOL SCALE WITH APPROXIMATELY EQUIVALENT "FRENCH" VALUES (PLASTIC CATHETERS)

# 0 - 12 French	# 4 - 25 French	# 8 - 35 French
# 1 - 15 "	# 5 - 27	# 9 - 37
# 2 - 19	# 6 - 29	#10 - 41
# 3 - 23	# 7 - 31	

millimeters, i e three (more accurately pi) times the outside diameter in millimeters

2 Magill (English) tubes in rubber and Portex plastic Magill tubes have their own scales. These scales with approximately equivalent French values are shown in Tables 2 and 3

3 Davol® plastic catheters also have a unique numbering system, which is similar to but not exactly the same as Magill scales It is shown in Table 4

NON REBREATHING VALVES

1 This device, which consists essentially of a tube with an inspiratory valve at one end and an expiratory valve on top has undergone several modifications in design most of which still may be secured

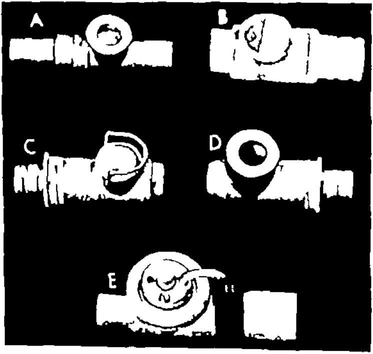

FIG. 5—Non rebreathing valves *A* Digby Leigh valve with metal discs *B* Digby Leigh valve of lucite with hinged rubber valves *C* Stephen-Slater valve with drapery guard and rubber disc valves *D* Stephen-Slater valve modified with positive pressure cap *E* Fink valve

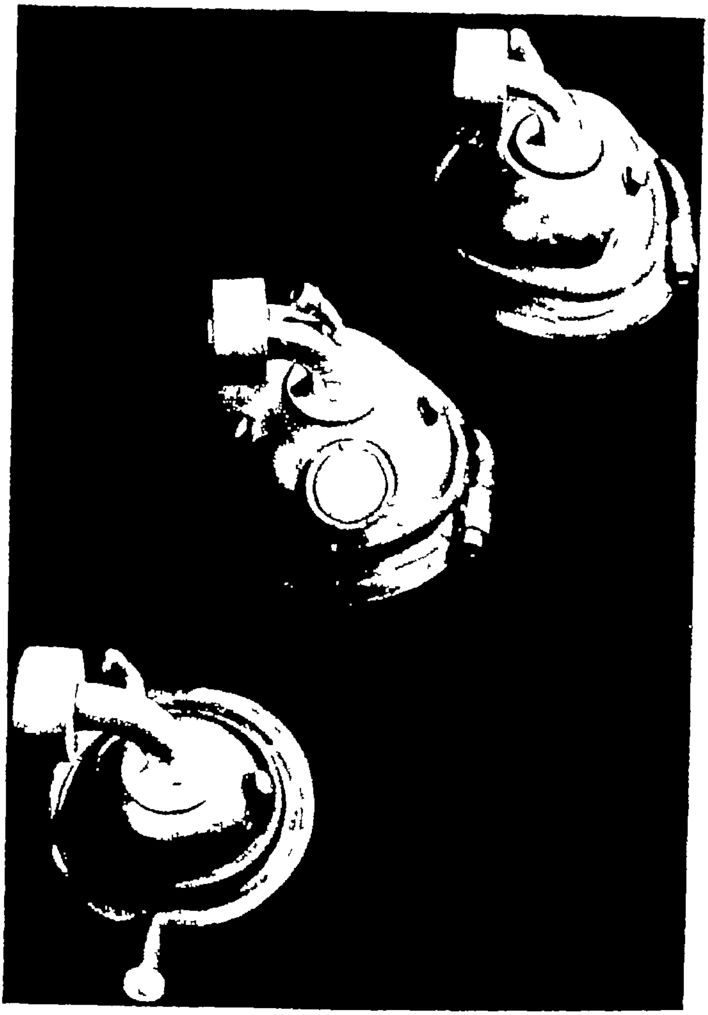

FIG 6—Pediatric face pieces and face cushions *Above,* child size *Middle,* child size with non-rebreathing valves *Below,* infant size

(a) Digby Leigh valve, old style, of metal with metal disc valves
(b) Digby Leigh valve, new style, of lucite with hinged rubber valves
(c) Stephen-Slater valve of metal with rubber disc valves
(d) Fink modification of Stephen-Slater valve, this type incorporates a diaphragm over the expiratory valve, pressure on the reservoir bag occludes the expiratory valve, assistance to respiration by positive pressure may be

accomplished thereby with one hand whereas with other types the expiratory valve must be occluded by the anesthetist s second hand

NON REBREATHING MASKS

1 These masks, similar in principle to the non rebreathing valve may be obtained in infant and child sizes.

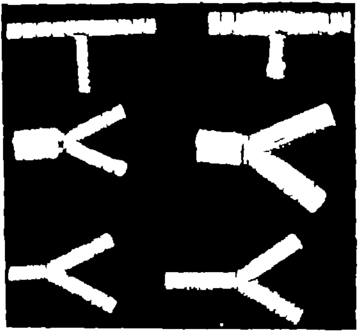

FIG. 7—Ayre s tubes. *Above* T type *Middle* Y type with slip-joint connections. *Below* usual Y type

AYRE S TUBES

1 These tubes may be purchased in two sizes However modifications can be made easily by using any type of Y tube, or by placing an escape hole in the metal or rubber tubing connected to the endotracheal tube

FLAGG CANS

1 These cans are made from discarded half or quarter pound ether cans by punching 3 or 4 holes in top of can and connecting fairly large bore rubber tubing or similar material

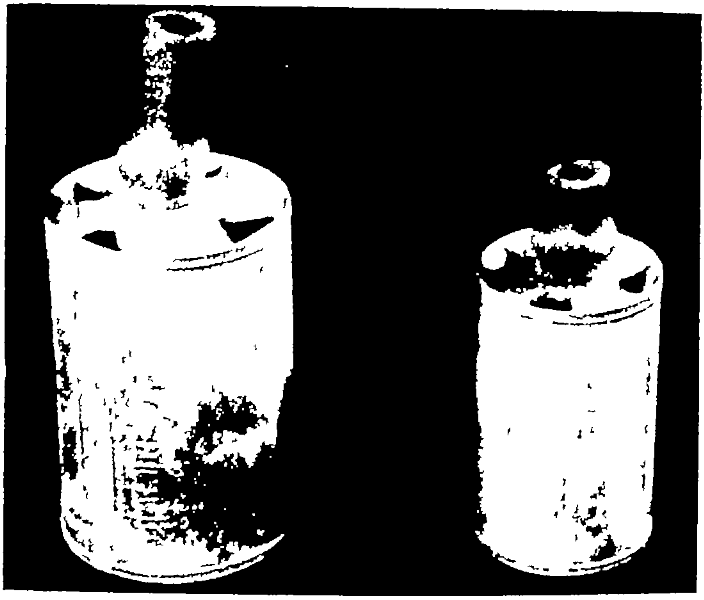

FIG 8—Flagg cans made from discarded ½- and ¼-lb ether tins

to mouth of can Direct connection is made to the endotracheal tube

INFANT CIRCLE FILTER

1 Several types of "circle" absorbers are available, modified in size, design, and resistance in an attempt to meet the physiologic requirements of infants

BLOOD PRESSURE EQUIPMENT

1 *Cuffs*

(a) In addition to the standard 5 inch cuff, the following sizes are available

Baum	*Becton-Dickinson*
Child's—3¾ in	Child's—3½ in
Infant's—2¾ in	Small child's—2 in
	Infant's—1 in

For further details and for a more complete survey of equipment for pediatric anesthesia, the reader is referred to the catalogues of the various manufacturers of anesthesia equipment, particularly The Foregger Company, Inc, 55 West 42nd Street, New York, N Y, The Ohio Chemical Company, Madison, Wis.

and The R. A Hawks Company 123 East Montecito Avenue, Sierra Madre Calif

4 TECHNICS

INDUCTION

1 *Open Drop Method*
A volatile anesthetic is dropped onto a gauze-covered mask held over the patient s face
(a) ADVANTAGES simplicity of equipment and technic relatively safe for the occasional anesthetist adaptable to children of all ages
(b) DISADVANTAGES anesthetist has no control of patient s ventilation in the infant induction may be prolonged stormy and accompanied by breath holding laryngo spasm, and hypoxia.

2 *Insufflation*
Gaseous anesthetic (nitrous oxide, cyclopropane, or a com bination) is blown gently on the patient s face from deliv ery tube of anesthetic machine
(a) ADVANTAGES relatively safe for the occasional anes thetist requires no special equipment occasionally useful in apprehensive child who is fearful of mask.
(b) DISADVANTAGE method is inefficient adequate con centration difficult to achieve if child is not quiet

3 *Circle filter*
Standard adult type apparatus Should not be used on chil dren under 10 to 12 years of age because of relatively high resistance with increased respiratory effort

4 *Infant circle filter*
Same as above but designed with principles such as de creased dead space and decreased resistance
(a) ADVANTAGES anesthetist may assist respiration efficient delivery of anesthetic gases useful for administration of cyclopropane
(b) DISADVANTAGES should be used only by skilled anes thetist equipment is cumbersome to operate believed by some anesthetists to offer too much resistance in spite of improved design

5 *To-and fro*
Bag and mask assembly with or without soda lime caniste

(a) ADVANTAGES efficient delivery of gases, useful for administration of cyclopropane, adaptable to all ages, anesthetist may assist respiration, ease of handling (unless soda lime canister is used from beginning of induction)

(b) DISADVANTAGES should be used only by skilled anesthetist, may be cumbersome if canister is used

6 *Intravenous*

Anesthetic agent, usually ultra-short-acting barbiturate, is administered through venipuncture or previously established infusion (Advantages and disadvantages are discussed under "Thiopental" [p 39])

7 *Rectal*

Tribromethanol or ultra-short-acting barbiturate introduced into rectum through catheter Usually accomplished in patient's room

(a) ADVANTAGES patient is unaware of trip to operating room and induction of anesthesia, sleep is produced quickly without apprehension or pain

(b) DISADVANTAGES respiratory depression may slow induction and increase danger of hypoxia, circulatory depression may contribute to shock in major surgical procedure, reaction time is prolonged, patient requires constant surveillance by anesthetist from time rectal instillation is made

MAINTENANCE BY NONENDOTRACHEAL TECHNICS

1 *Open Drop* as described

(a) ADVANTAGE simplicity of technic and relative safety for the occasional anesthetist

(b) DISADVANTAGES anesthetist unable to assist respiration, danger of accumulation of carbon dioxide under mask

2 *Circle filter* as described

3 *To-and-fro* as described

(a) ADVANTAGE anesthetist may assist or control respiration

(b) DISADVANTAGES heat generation and retention—this is the major objection to maintenance by this technic Heat generated by the interaction of expired carbon

dioxide and soda lime is not dissipated Alarming elevation of temperature may occur if canister is not cooled or changed frequently awkwardness—anesthetist may have difficulty in maintaining satisfactory airway and keeping mask in correct position because of heavy apparatus

4 *Insufflation* Anesthetic-oxygen mixture is insufflated into pharynx by means of ether hook pharyngeal airway special mouth gag equipped with delivery tube nasal catheter

(a) ADVANTAGES simplicity of technic adequate removal of carbon dioxide if ventilation is adequate

(b) DISADVANTAGES anesthetist has no control of airway or ventilation large volumes of anesthetic mixture are required to maintain depth of anesthesia, especially in older children

5 *Non rebreathing mask*

(a) ADVANTAGES carbon dioxide elimination is accomplished efficiently without use of soda lime anesthetist may assist respiration by intermittent compression of reservoir bag and simultaneous occlusion of expiratory valve useful for administration of nitrous oxide and trichloroethylene.

(b) DISADVANTAGES may be difficult to maintain adequate depth of anesthesia (except nitrous oxide and trichloroethylene) requires relatively large volumes of gas

ENDOTRACHEAL ANESTHESIA

1 *General considerations*

The use of the endotracheal catheter in infants and children has been accepted slowly by physicians because it was felt that it would invariably lead to edema or other trauma of the respiratory tract. Sufficient experience has now accumulated to prove that endotracheal anesthesia in all ages (even in the newborn and premature) is a safe and desirable technic, provided it is skillfully administered It is not a technic for the occasional anesthetist or the beginner

2 *Advantages*

(a) Elimination of anatomic obstruction to airway (lips, tongue, tonsils, larynx)

tenance e g to-and fro and the standard or infant circle filter systems The quality and safety particularly of open drop technic is greatly improved by the use of the tracheal tube

(b) Tracheal insufflation (Ayre s technic) Anesthetic gases in large flow are introduced directly into the tracheal tube by means of a T or Y tube, one arm of which is left open to the air

ADVANTAGES simplicity and lack of cumbersome equipment respiration may be assisted (by intermittent occlusion of open end of tube) carbon dioxide and heat are easily dissipated.

DISADVANTAGES technic is inefficient sufficiently deep anesthesia may be difficult to attain in larger children

(c) Non rebreathing valve.

ADVANTAGES respiration may be skillfully controlled or assisted (by intermittent compression of the reser voir bag and simultaneous occlusion of expiratory valve) there is no rebreathing carbon dioxide and heat retention are avoided.

DISADVANTAGE technic is somewhat inefficient may be difficult to attain deep anesthesia in larger children

(d) Flagg can.

ADVANTAGES simplicity deep anesthesia easily obtained in children of any age respiration may be assisted (by introduction of relatively large flows of oxygen into tubing and intermittent occlusion of tubing be hind site of entry of oxygen)

DISADVANTAGE relatively large dead space carbon di oxide may accumulate unless large flows of oxygen are used or non rebreathing valve interposed between can and endotracheal tube.

SPINAL ANESTHESIA

Age per se does not preclude the use of spinal anesthesia it may be successfully administered to the smallest child or in fant. However since general anesthesia is satisfactory for most pediatric surgical conditions, spinal anesthesia is usually reserved for those situations in which inhalation anesthesia is

contraindicated or would be technically difficult or dangerous, such as in liver or kidney disease, respiratory infection, hyperpyrexia, or acidosis

1 ADVANTAGES minimal disturbance of body chemistry and function, minimal postoperative nausea and vomiting, excellent muscular relaxation

2 DISADVANTAGES may be technically difficult to administer, child may be distressed at inability to move lower extremities; level of analgesia more difficult to control than in adult

NOTE These disadvantages can be minimized to some extent by use of large doses of sedative drugs or induction of light anesthesia before lumbar puncture is performed

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SECTION II GENERAL POSTOPERATIVE CONSIDERATIONS

CHAPTER 4

The Normal Postoperative Period

WILLIAM K SIEBER

THE NORMAL POSTOPERATIVE PERIOD refers to the usual smooth, uncomplicated, short period following operation In general, infants and young children recuperate from major surgical procedures faster and more completely than adults

RECOVERY PERIOD

This begins with cessation of anesthesia and ends with return of consciousness and normal vital signs

1 *Recovery period* is best managed by specially trained personnel in a recovery room where facilities for emergencies (tracheotomy, bronchoscopy, laryngeal intubation, and cardiac massage) are readily available
2 *Management*
   (a) Nurse must be in constant attendance until consciousness is regained
   (b) Vital signs (pulse, respirations, blood pressure) must be checked and recorded every 15 minutes or oftener until stabilized
   (c) In infants, vital signs are best recognized by the color, character of respirations, and the auscultatory heart rate
   (d) Position to favor normal, unobstructed breathing

(e) Oxygen and suction must be available.

3 *Complications* are apt to be respiratory and circulatory system emergencies

PAIN

1 *General considerations*
   (a) Pain should be relieved by sedation rather than narcosis.
   (b) Infants rarely require narcotics.
   (c) Drugs are given as needed for comfort rather than by schedule

2 *Drugs*
   (a) Barbiturates
      i) Orally
         a) Elixir phenobarbital (gr 1/8 or 1/4 per dr) (8 mg or 16 mg. per 4 cc.)
      ii) Hypodermically—subcutaneously or intramuscularly
         a) Sodium phenobarbital
            1) 8 to 15 mg to age 2 (1/8 gr to 1/4 gr)
            2) 30 mg ages 2 to 5 (1/2 gr)
      iii) Rectally
         a) Sodium phenobarbital
            1) Maximal dose 006 mg (gr 1/10) per pound body weight—not to exceed 0 4 Gm. (6 gr)
               a) Under 2 years—0 3 to 0 1 Gm. (1/2 to 1 1/2 gr)
               b) 2 to 6 years—0 1 to 0 2 Gm (1 1/2 to 3 gr)
               c) 6 to 12 years—0 2 to 0 4 Gm (3 to 6 gr)
         b) Seconal® (sodium propylmethylcarbinylallylbarbiturate)
            1) Minimal dose 0 003 Gm. (1/20 gr) per pound body weight not to exceed 3 gr as total dose. Maximal dose same as sodium phenobarbital
               a) Under age 2—0 03 to 0 1 Gm (1/2 to 1 1/2 gr)
               b) 2 to 6 years—0 1 to 0 15 Gm. (1 1/2 to 2 1/2 gr)
               c) 6 to 12 years—0 15 to 0 2 Gm (2 1/2 to 3 gr)

(b) Acetylsalicylic acid (aspirin)
- i) (0.06 Gm) (gr 1) per year of age until age 5, more than 0.3 Gm seldom necessary
- ii) Often used with codeine
- iii) May be used in freshly prepared solution (Danger Solution forms salicylic acid on standing)

(c) Codeine

Age	Dose	Grams
1 month	gr 1/50	0.0012
3 months	gr 1/25	0.0025
1 year	gr 1/8	0.008
2 years	gr 1/6	0.01
5 years	gr 1/4	0.015

(Give orally or hypodermically in same dosage)

(d) Morphine
- i) May be necessary in older children and in special problems such as cardiac patients
- ii) Dose Follows that of preanesthetic medication—0.06 to 0.1 mg (1/1000 to 1/6000 gr) per pound of body weight

(e) Demerol® (meperidin)
- i) Indicated where undesirable gastrointestinal effects of morphine are to be avoided, less analgesic than morphine
- ii) Dose 1.5 mg /kg body weight

(f) Paregoric (camphorated tincture of opium) Rarely indicated—causes constipation

Age	Dose	
1 month	2 min	0.12 cc
3 months	3 min	0.2 cc
1 year	10 min	0.6 to 1.3 cc
2 years	10 to 20 min	0.6 to 1.3 cc
5 years	30 min	2 cc

FLUIDS AND ELECTROLYTES

1 Usually fluids and electrolytes have been corrected preoperatively and oral feedings rapidly rectify residual preoperative deficits, making prolonged postoperative administration of fluids and electrolytes unnecessary

2 In complicated problems where oral intake is impossible as in intestinal surgery a continuation of preoperative fluid administration becomes necessary

3 *General principles*

(a) Maintenance and correction of sustained losses must be considered in computing daily requirements Deficits have usually been replaced preoperatively and rarely require consideration.

(b) Overhydration is a greater danger than dehydration (see Chapter 2)

(c) Laboratory tests are unnecessary when fluids are to be given for only a few days

(d) Potassium is rarely necessary except where fluids must be given for more than two days If used 1 mEq /lb (2 mEq /kgm.) is maintenance dose

(e) Do not give potassium unless

i) Shock is corrected.

ii) Renal function is adequate

(f) Fluids are administered intravenously *only* Subcutaneous fluids if given at all, should never consist of glucose water since this will accentuate dehydration and reduce electrolyte concentration Subcutaneous fluid must be hypotonic to allow water absorption

(g) Volume deficits must be replaced first Precise calculation of electrolyte deficits is undependable since spaces cannot be accurately measured (see Appendix)

(h) Ammonium chloride and sodium bicarbonate solutions are rarely indicated

(i) Clinical judgment is the most reliable guide to fluid requirements Fluid requirements are gauged by the following clinical considerations

i) Skin turgor

ii) Dryness of lips and mouth.

iii) Weight loss or gain

iv) Urine output

v) Fluid losses from gastric suction exudates, drainage, and fistulas

(j) 5% glucose in water is the basic fluid used to this, are added

i) 5% glucose in 0 9% saline solution
ii) 1/6 molar lactate solution
iii) Potassium chloride solution (20 mEq per 10 cc)

(k) When prolonged intravenous fluid administration is necessary and oral intake impossible, the nutritional status of the patient deteriorates This may be slowed by the administration of
i) Amino acid hydrolysates such as amigen or amenasal (febrile reaction common)
ii) Plasma—serum hepatitis transmission a danger.
iii) Serum albumin—expensive but beneficial in edema—1 to 2 cc per lb
iv) Whole blood
v) A combination of plasma and whole blood, 5 to 10 cc per pound of body weight every second day is preferred when prolonged fluid administration is necessary In such situations the hemoglobin and red cell counts are misleading when used to determine need for transfusion A normal or high count does not contraindicate transfusion, since these patients have a reduced total blood volume

(l) Water soluble vitamins (vitamin C and vitamin B complex solution) are administered as daily maintenance requirement
Vitamin C or ascorbic acid—100 mg
Vitamin B complex (soluble)—1 cc

ANTIBACTERIAL DRUGS

1 *Indications*

(a) Pre and postoperative prophylaxis
i) All newborn infants undergoing surgery
ii) Congenital or acquired heart disease.
iii) Major thoracic, abdominal, genitourinary, and neurosurgical procedures
iv) Injuries
v) Chronically ill, malnourished, debilitated children having a primary disease interfering with nutrition Resistance to infection understandably low in such children

TABLE 1—Antibacterial Drugs

	Dose	*Schedule*	*Mode of Administration*
Penicillin aqueous	100 000 to .00 000 U dose up to 1 000,000 U/day	6 hr	IM or IV
Penicillin, procaine	*300,000 U* or 600,000 U/day	*Daily* or b.i.d.	*IM* only
Streptomycin	25 to 50 mg./kg./day up to 1 Gm./day	1 hr	IM or IV
Dihydrostreptomycin	Same as streptomycin, available in combination *with streptomycin*		
Tetracycline	5 mg./kg./day	6 hr 8 hr	Oral IV
Chlortetracycline	Same as tetracycline	6 hr 8 hr	Oral IV
Oxytetracycline	Same as tetracycline	6 hr 8 hr	Oral IV
Chloramphenicol	25 to 50 mg./kg./day 25 to 100 mg./1 kg./day	4 to 6 hr 6 hr	Oral IV
Erythromycin	10 to 15 mg./kg./day Never over 200 mg./day	6 hr 6 to 8 hr	Oral IV
Polymyxin B	2 5 mg./kg./day Never over 200 mg./day	6 hr	IM
Sulfadiazine	0 1 to 0 2 Gm./kg./day (gr 1/lb./day) up to 120 gr)	4 hr 6 to 8 hr	Oral IV

TABLE 1 —ANTIBACTERIAL DRUGS *(cont.)*

	Dose	*Schedule*	*Mode of Administration*
Gantrisin	0 1 to 0 2 Gm / kg /day (1 gr / lb /day up to 120 gr)	4 hr 6 to 8 hr	Oral IV
Sulfasuxidine	150 mg /lb /day	4 times day	Oral
Furadantin	5 mg /kg /day, infant 10 mg /kg /day, older children	4 times day	Oral

(b) Specific infection such as peritonitis, osteomyelitis, and tuberculosis
(c) Preparation for colonic surgery

2 *General usage*

(a) Up to age 18 months, penicillin combined with streptomycin administered intramuscularly every 6 to 8 hours is the most generally used antibiotic combination
(b) Beyond this age, streptomycin is unnecessary
(c) If indicated beyond 7 to 10 days, a broad spectrum antibiotic of the tetracycline series or some other antibiotic, as indicated bacteriologically, is substituted
(d) The sulfonamides are most effective in genitourinary infections and in infections due to gram negative organisms
(e) Discontinue therapy
i) When signs of infection have subsided for from 4 to 7 days
ii) When the indication no longer exists
iii) 24 to 48 hours prior to hospital discharge
iv) When drug intolerance is noted
(f) Combinations of these drugs, such as penicillin and streptomycin, can be synergistic Other combinations such as penicillin and aureomycin, may be antagonistic

3 *Complications of antibacterial therapy*

(a) Drug sensitivity

i) Manifested by skin eruptions fever urticaria, edema Penicillin is the most common offender

ii) Treatment

a) Discontinue drug

b) Antihistaminic drugs Syrup of benadryl® (0 5 mg to 1 0 mg per lb body weight)

c) Epinephrine every 4 hours may be necessary for laryngeal edema.

(b) Change of normal bacterial flora

i) Thrush Overgrowth of monilia albicans in mouth and pharynx Common in long-continued penicillin therapy in infants

a) *Treatment* Remove white crusts with applicator and apply gentian violet, caprolate or Mycostatin solution (Mycostatin is specific for this fungus infection) Repeat twice daily

ii) Fulminating enterocolitis is due to resistant Staphylococcus infection. It is associated with orally administered antibiotics usually of the tetracycline series Often fatal Seen in megacolon and in preparation of intestine for colonic surgery

iii) B proteus and B pyocyaneus are resistant organisms, sometimes causing death by terminal septicemia in a chronically ill debilitated newborn infant in spite of antibiotic therapy

(c) Specific complications

i) Streptomycin-deafness, tinnitus and vestibular dysfunction may occur as early as the fourth day but usually require one or more months of drug administration Streptomycin combined with dihydrostreptomycin, each providing half the required dose reduces the toxicity The drug is best used in this fashion. As a precaution streptomycin should not be administered beyond 7 to 10 days unless specifically indicated

ii) Tetracycline drugs may cause gastrointestinal symptoms with nausea and vomiting Looseness of bowels is common and does not contraindicate continuation of the drug

FIG 9—An easily constructed, light framework to fit over a crib to prevent patient from climbing out

DIET

Oral intake may be resumed early except in abdominal surgery or where ileus is expected Infants need miss no more than one or two feedings The first postoperative feeding can be glucose water or plain water, followed by formula Older children require slower progression of feeding

BOWELS AND BLADDER

1 Catheterization is seldom necessary except in neurologic and anorectal problems in which catheter usually is inserted prior to surgery
2 Bowel movements usually are unaltered by surgery Dehydration and inactivity may induce constipation and fecal

impactions. Preoperative cleansing enemas and awareness of this postoperative possibility make such complications unusual

AMBULATION

1 Early and complete activity and ambulation mark recovery A sick child or a child in pain will not move. Unwilling ness to move indicates a surgical complication, pain or continuing illness Usually the older the child the more apprehensive and the more motions are voluntarily re stricted

2 Restraints of extremities or use of a cribtop are neces sary

   (a) In certain orthopedic and plastic procedures.

   (b) Where drains or tubes (such as a thoracotomy tube) must not be disturbed.

   (c) Where movements interfere with required treatment such as intravenous administration of fluids and gastric suction

CHAPTER 5

The Abnormal Postoperative Peric

WILLIAM K SIEBER

COMPLICATIONS IN THE postoperative period, such as those f
lowing, should be foreseen, and preparation made for them

SHOCK

A syndrome of circulatory insufficiency due to a deficienc
circulating blood volume (hypovolemic shock)

1 *Recognized by*
   (a) Pallor, coldness, respiratory irregularity progressing
   apnea, weak, rapid pulse
   (b) In older children, sweating and lowered blood pressu
   are observed
   (c) State of consciousness is usually obscured by underly
   condition
   (d) Delayed shock during postoperative period signi
   hemorrhage
2 *Causes*
   (a) Excessive manipulation, roughness of surgical techr
   (b) Aspiration (mucus plug or vomitus)
   (c) Coldness
   (d) Trauma
3 *Prevent by*
   (a) Gentleness during surgery

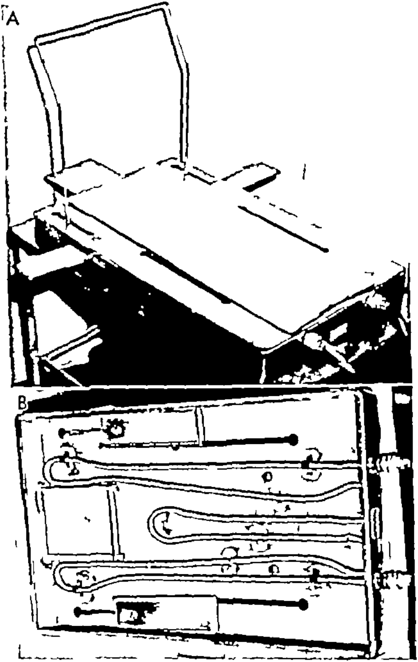

FIG. 10.—*A* specially constructed infant operating table with heating and cooling water coils underneath to regulate temperature. *B* underneath view of operating table showing heating and cooling unit.

(b) Careful hemostasis during surgical procedure.
(c) Adequate blood replacement during operation

2. *Procedures in which postoperative hemorrhage is most apt to occur*
(a) Tonsillectomy and adenoidectomy
(b) Laparotomy where large tumors spleen or liver are resected
(c) Procedures in the presence of jaundice.

3 *Treatment*
(a) Control obvious bleeding
i) Suture skin for skin-edge bleeding
ii) Ligate visible vessel
iii) Pressure packing
iv) Reoperation seldom necessary for control of bleeding
(b) Replacement of blood with typed whole blood is specific treatment for hemorrhage.
i) Blood pressure will return to normal first—the pulse later
ii) Recovery may be abrupt making overloading a real danger
(c) In the absence of whole blood intravenously administered, solutions to provide replacement volume may be temporarily lifesaving Plasma, 6% dextran, gelatin glucose and saline solutions are effective in providing volume replacement, but fail to give needed hemoglobin.
(d) Vasopressor drugs (norepinephrine ephedrine, epinephrine, neosynephrine) are contraindicated except when intravenous fluid is unavailable

HYPERTHERMIA

Moderate temperature elevation is not unusual in the postoperative period Hyperthermia refers to temperature elevations over 102 F

1 *Recognition*
(a) Fever—temperature elevation over 102 F
(b) Flushed face—dry lips, hot forehead

2 *Causes*
(a) Dehydration

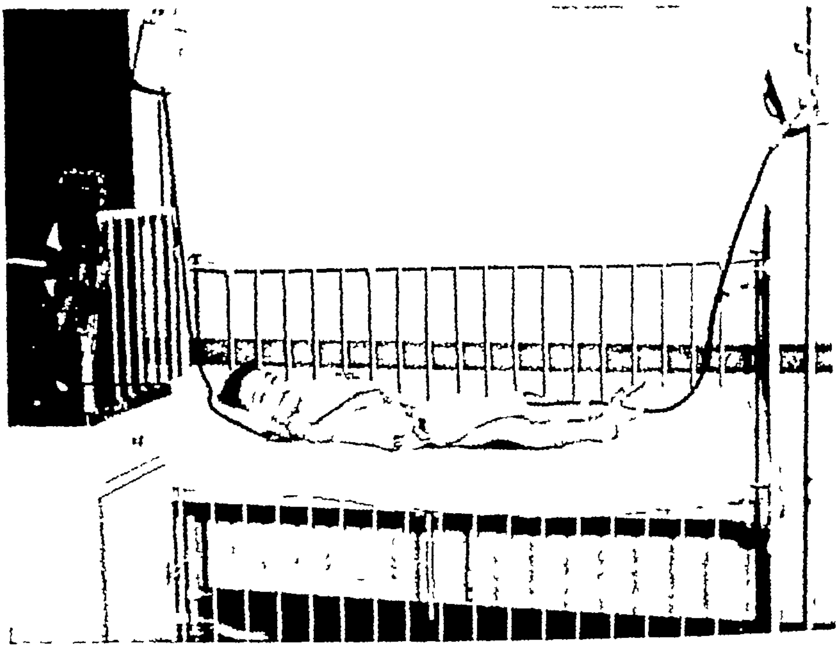

FIG 11—Physical methods by which hyperthermia can be combated ice water mattress, ice water enema, ice bags to body and extremities, exposure of unclad body, electric fan

(b) Infection
  i) Wound infection
  ii) Deep abscess formation
    a) Pelvic abscess in intra-abdominal surgery
    b) Empyema in thoracic surgery
    c) Ruptured intestinal suture line
  iii) Otitis media secondary to endotracheal intubation
  iv) Urinary tract infection secondary to catheterization
(c) Infectious diseases
  i) Rubella, rubeola, roseola infantum, surgical scarlet fever
(d) Neurosurgical procedures due to
  i) Midbrain irritation
  ii) Blood in spinal fluid
(e) Excess external heat

3 *Dangers*

The greatest hazard of hyperthermia is a febrile convulsion The physiologic changes associated with hyperthermia in-

clude elevation of pulse and respiratory rates and an increase in metabolic rate These strain physiologic reserves and impair recovery

4 *Management*

(a) Prompt measures to reduce the body temperature.
 i) Fluids—orally and intravenously
 ii) Icebags
 iii) Water mattress
 iv) Alcohol sponge
 v) Fan
 vi) Remove all clothing and covering to allow maximum heat loss
 vii) Salicylates
 viii) Ice water enemas are seldom necessary

(b) A thorough physical examination with special attenti to nose and throat chest and abdomen to discover t cause of hyperthermia

(c) Appropriate treatment of cause
 i) Antibacterial agents—where indicated
 ii) Drainage of abscess
 iii) Correction of dehydration

CENTRAL NERVOUS SYSTEM COMPLICATIONS

1 *Convulsions*

(a) Causes
 i) Neurologic diseases and procedures
 ii) Hyperthermia (febrile convulsions)
 iii) Toxemia due to infection or drug sensitivity
 iv) Specific infections such as tetanus and meningitis.
 v) Secondary to cerebral embolism or thrombosis in c diac patient
 vi) Anoxia.
 vii) Hypocalcemic tetany in newborn infants
 viii) Water intoxication

(b) Recognized by Clonic generalized contractions Rar localized Jacksonian except in neurologic lesions a neurosurgical patients Close and prolonged observati may be necessary to detect convulsive movements st ing, and inco-ordination in infants

(c) Management
- i) Control convulsion with
  - a) Barbiturate—rectally
  - b) Calcium gluconate intravenously
  - c) Rectal ether
  - d) Rectal avertin
  - e) Muscular relaxants, such as succinyl choline, are too dangerous
  - f) Paraldehyde—a dangerous drug
- ii) Specific treatment of causes
  - a) Treat hyperthermia
  - b) Specific treatment of tetanus, meningitis, or other cause

RESPIRATORY TRACT COMPLICATIONS

1 *Atelectasis*—collapse of a pulmonary segment, lobe, or lung

(a) Pathogenesis
- i) Obstruction of the entering bronchus or bronchiole by intrinsic mucus plug or by external pressure
- ii) Congenital nonexpansible lung as in congenital diaphragmatic hernia

(b) Causes
- i) Pulmonary infection
  - a) Tracheobronchitis
  - b) Pneumonitis
- ii) Procedure causing limitation of respiratory motion and cough by pain
  - a) Upper abdominal operations, as on liver and spleen
  - b) Transthoracic procedures
- iii) Aspiration of gastric contents as in
  - a) Intestinal obstruction
  - b) Anesthesia administered when stomach full

(c) Recognition
- i) Sudden onset
- ii) Shock-like state with pallor and shallow, rapid respirations in infants
- iii) In older children the only symptom may be mild respiratory distress

iv) Chest pain and fever progressing to cyanosis
v) Physical signs
  a) Deviation of trachea to side of involvement—usually demonstrable only in upper lobe collapse
  b) Signs of atelectasis are those of consolidation
    i Bronchial breathing
    ii Increased tactile fremitus
    iii Usually rhonchi in adjacent trachea, or bronchi
vi) Roentgen findings
  a) Roentgen findings are usually diagnostic
vii) Treatment
  a) Oxygen for respiratory distress and cyanosis
  b) Stimulate cough by voluntary coughing and tracheal suction with a catheter
  c) Bronchoscopy
  d) Antibiotics to protect against abscess and pneumonitis

2 *Tracheobronchitis*—inflammation of lower respiratory passages.

(a) Occurrence—apt to result when
  i) Anesthesia and operation are performed when coryza or other respiratory tract infections are present
  ii) Endotracheal intubation is used This complication due to
    a) Trauma.
    b) Repeated endotracheal intubation

(b) Recognition
  i) Onset usually within 24 hours of operation
  ii) Cough.
  iii) Increasing stridor

(c) Physical findings
  i) Râles in trachea.
  ii) Inspiratory retraction of chest wall
  iii) Laryngeal obstruction

(d) Treatment
  i) Antibiotics to prevent secondary infection.
  ii) Humidity (cold steam vaporizer)
  iii) Symptomatic treatment.
  iv) Tracheotomy may become necessary

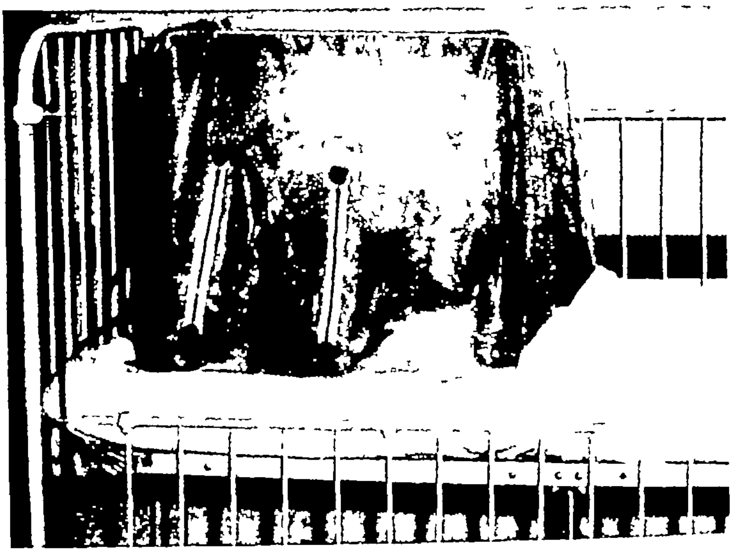

FIG 12—A croupette for delivering oxygen and high humidity to a postoperative patient with tracheobronchitis

3 *Pneumonia* Massive postoperative pulmonary infection is usually bronchopneumonic rather than lobar Bronchopneumonia is one of the common causes of death in postoperative newborn infants

(a) Occurrence

i) In infants, most commonly due to aspiration

ii) Preoperative bronchitis or other respiratory tract infection may be the cause

(b) Recognition

i) In infants, pneumonitis is often not clinically detectable until massive disease is present and the infant in terminal condition Only then, may fever, severe respiratory distress, and cyanosis appear

ii) Classical symptoms—fever, increased respiratory rate progressing to respiratory distress, and retraction with inspiration and cyanosis appear late

iii) Physical signs

a) Signs are undependable and late in appearing—especially in infants

b) Decreased aeration progressing to bronchial breathing with occasional râles, and, if fluid accumulation occurs, lack of breath sounds

c) Repeated examination important to detect improvement and changes
d) Reduced motion of involved side.
e) With distress retraction of sternum during inspiration.
f) Often associated with ileus and abdominal distention.

(c) Treatment
i) Oxygen.
ii) Antibiotics
iii) Prevention and treatment of cause such as
a) Relief of intestinal obstruction.
b) Pharyngeal suction

(d) Pulmonary infarctions (embolism)
i) A rare complication seen in cardiac, nephrotic, and steroid therapy patients

GASTROINTESTINAL COMPLICATIONS

1 *Hiccough*—diaphragmatic spasm with closed glottis
(a) Usually transitory during recovery period.
(b) When protracted or when occurring after recovery period may indicate serious gastrointestinal complication (as peritonitis) or neurologic or genitourinary tract complication
(c) Danger if protracted is exhaustion
(d) Treatment
i) Rebreathing
ii) Oxygen—carbon dioxide-oxygen mixture.
iii) Drugs
a) Emetics
b) Sedatives
iv) If protracted
a) Local anesthesia and phrenic nerve block.
b) Phrenic nerve crush—a dangerous procedure.
c) General anesthesia or narcosis

2 *Ileus*
(a) Cause
i) Respiratory tract disease usually pneumonia.
ii) Genitourinary tract disease usually obstructive uropathy or infection

iii) Shock
iv) Excessive manipulation in abdominal operations
v) Infection—as septicemia
vi) Peritonitis
a) Chemical, as from blood in peritoneal cavity
b) Infectious.

(b) Recognition
i) Abdominal distention
ii) Emesis
iii) No evacuation
iv) Physical examination
a) Distention
b) Tympany
c) No audible peristalsis
v) Roentgen examination

(c) Differential diagnosis
i) From mechanical intestinal obstruction by
a) Absence of peristalsis
b) Lack of a specific dilated loop of intestine demonstrated roentgenographically

(d) Treatment
i) All postoperative patients have a mild temporary ileus which requires no treatment More protracted need
a) Continuous gastric suction
b) Oxygen
c) Sedation—preferably demerol® if narcosis is necessary
d) Drugs—prostigmin® rarely helpful
e) Patience
f) If response is slow, or fails in spite of these measures, look for cause in genitourinary and respiratory tracts

3 *Fistulas*

(a) These may be
i) Intentional, as colostomy or double barreled ileostomy in the treatment of low atresia of the intestine, or
ii) A complication of gastrointestinal surgery, such as

FIG. 13—Infant with skin erosion as the result of a high jejunal fistula

a) Duodenal fistula following pyloromyotomy
b) Small intestinal fistula in regional enteritis
c) Colonic fistula in ulcerative colitis

(b) Recognition
1) Discharge of intestinal contents through an opening in the abdominal wall Prove by
a) Feeding a colored solution and recovering fluid in drainage Carmine red or charcoal the best substances to use.
b) Injecting the tract with radiopaque medium (usually barium water mixture) under fluoroscopic visualization Roentgenograms allow
i Verification of the presence of a fistula.
ii Identification of portion of intestinal tract involved

(c) Management
1) Prevent local tissue destruction by the use of protective ointments to skin The following preparations are useful
a) Silicone ointment—must be applied prior to any skin irritation or destruction.
b) Zinc oxide ointment.
c) Yeast paste

ii) Skin erosion and tissue destruction are apt to occur in high fistulas (small intestinal, gastrostomy, ileostomy, transverse colostomy), because of digestive enzymes Prevention is much simpler than correction by·
a) Removing drainage
b) Repeated dressing changes
c) Suction devices
i Sump drain
ii Often unsuccessful and disappointing
iii Catheter drainage
d) Correcting fluid and electrolyte disturbances incident to continuing losses through the fistula This requires careful collection and measurement of material Collection may be difficult and inaccurate (see Chapter 2)
e) The only definitive treatment is surgical closure of the fistula

4 *Fecal impaction*

(a) Recognition
i) No bowel movement but often constant straining with passage of small amounts of liquid material
ii) Fecal staining or incontinence
iii) An abdominal mass in midline and left lower quadrant of the abdomen with abdominal distention and palpable colon
iv) Digital rectal examination confirms presence of impaction

(b) Prevention
i) Preoperative enemas where impaction can be anticipated postoperatively
ii) Consider the probability in children with the following disorders
a) Chronic constipation
b) Megacolon
c) Neurologic lesions
d) Orthopedic lesions
e) Poliomyelitis
f) Imperforate anus

(c) Treatment

i) Enema—saline

ii) If a cleansing enema is unsuccessful the following routine will usually be effective

a) Hydrogen peroxide (3%) 1 part to 3 parts saline enema followed by instillation of 4 fluid dr mineral oil as retention enema

b) One half hour later a cleansing saline enema repeat twice daily

iii) If available, 1% aerosol OT 5 cc. in a saline enema as a retention enema is effective

iv) Digital removal seldom necessary

5 *Vomiting*

(a) Causes

i) Ileus

ii) Infection (peritonitis abscess)

iii) Intestinal obstruction

iv) Poor nursing care in feeding of newborn and infants This includes

a) Failure to 'burp' completely

b) Rapid feeding and too much feeding

v) Urinary tract disease

(b) Management

i) Discontinue all feedings

ii) Find cause of emesis

a) Evaluate as to infection postoperative status of the alimentary tract patency of anastomosis and so on

b) Roentgenologic examination of chest and abdomen for obstruction ileus, and pneumonitis is helpful. (Do not hesitate to use this aid in infants and young children not responding in a reasonable period postoperatively)

iii) Gastric suction—continuous or intermittent

iv) Intake and output chart must be maintained

v) Supply intravenous fluids as indicated

vi) Treatment of cause

a) Ileus usually responds spontaneously

b) Abscesses adhesions, perforations may require reoperation.

6 *Distention*

(a) Abdominal distention interferes with diaphragmatic motion, resulting in respiratory distress This is a most important consideration in infants since their respirations are predominantly diaphragmatic Crowding of the diaphragm from below also reduces the vital capacity Distention is often accompanied by vomiting, which promotes aspiration and pneumonitis, further embarrassing respirations

i) Cause

a) Postoperative ileus

b) Unrelieved intestinal obstruction.

c) Pneumoperitoneum—usually secondary to a perforated viscus

d) Abdominal mass (as hydronephrosis or hematoma)

e) Air swallowing

f) Tracheo-esophageal fistula

ii) Management

a) Nothing by mouth

b) Gastric suction

c) Careful examination to detect cause (if obstruction is present this must be relieved surgically)

d) Intravenous fluids as required

GENITOURINARY COMPLICATIONS

1. *Urinary retention*—rare

(a) Usually associated with a neurologic disorder or an unsuspected congenital anomaly

(b) Can occur in pelvic, rectal, and perineal procedures when nervi erigentes are disturbed

(c) Recognition

i) Failure to urinate

ii) Bladder palpable suprapubically.

iii) Overflow dribbling

(d) Treatment

i) Heat to abdomen, preferably in warm tub

ii) Furmethide

iii) Catheterization

(It should be recalled that oliguria commonly occurs postoperatively for as long as 24 hours Catheterization is rarely necessary)

2 *Anuria*—lack of formation.

(a) Recognition
- i) Failure to urinate
- ii) Bladder empty on catheterization.
- iii) Often a small amount of grossly bloody or murky urine can be obtained by catheter

(b) Cause
- i) Incompatible blood transfusion
- ii) Shock.
- iii) Lower nephron nephrosis
- iv) Error of surgical technic—as ligation of ureters in pelvic or colonic surgery

(c) Management
- i) Ascertain the cause.
- ii) Correct any surgical error that may have been made
- iii) Treat shock.
- iv) Limit fluids to less than daily maintenance requirements.
- v) Specific therapy—artifical kidney

EXTREMITIES—COMPLICATIONS

1 *Phlebitis*

(a) Causes
- i) Seldom occurs spontaneously except in cardiac patients with polycythemia.
- ii) A common sequel of continued intravenous fluid administration by cut down or needle

(b) Recognition
- i) Redness tenderness swelling along course of vein.
- ii) Temperature elevation.

(c) Management
- i) Remove intravenous needle or cut down tubing
- ii) Warm saline compresses
- iii) Remove sutures in cut down
- iv) Antibiotic therapy usually unnecessary

(d) Dangers
- i) Sloughing of skin with ulceration (rare)
- ii) Embolism (exceedingly unusual)

CHAPTER 6

Care of Wound

WILLIAM L WHITE

PHYSIOLOGY OF WOUND HEALING

REACTION TO injury begins locally, initiating a progression of phenomena, the end point of which is healing of the injury. For the surgeon, an understanding of these mechanisms is essential for surgical therapy frequently superimposes additional injury upon patients already in a profound state of disturbance and reaction. In addition, the surgeon must be aware of the factors which interfere with eventual repair and be prepared to correct or eliminate them, for effective surgical therapy is precisely limited by the ability of the tissues to heal.

THE IRRITANTS

Agents which inflict injury are known as irritants and may be described as

A Physical (mechanical, heat, cold, radiation, electrical, etc)

B Chemical (pathogenic organisms or other noxious agents)

While there is a fundamental pattern of reaction to all irritants different irritants elicit different reactions. The scope of these variations may be extreme. It is the knowledge and understanding of these differences that constitute the basis of differential diagnosis.

THE FUNDAMENTAL MECHANISMS

There are three fundamental mechanisms in reaction to injury and repair

Inflammation (the basic reaction)

Catabolism (clearing the wound of necrotic and foreign material)

Repair (by fibroplasia and epithelization)

In terms of cellular activity each of these stages occurs in sequence in the given order Clinically it is impossible to determine at what point one stage concludes and another begins, for there is a continuous blending of one process into another

INFLAMMATION

Inflammation is the local reaction of the body to the irritant force and to the cellular damage it produces The purpose of the inflammatory reaction is to establish a system of defense and institute the mechanisms for wound clearing and eventual local tissue repair Primarily this reaction involves the blood vessels, for they are the avenues of defense and supply The star performers in this drama are the leukocytes and macrophages whose performance is dependent upon the environmental solutions in which they exist Since the irritant and the damaged cells are generally located outside the blood vessels the highlight of inflammation, as pointed out by Cohnheim is the selective transference of these essential elements from the bloodstream through intact vessel walls This transference is known as the vascular phenomena, which is responsible for the familiar clinical signs of inflammation *rubor calor tumor* and *dolor* described by Celsus in 25 B C.

A Vascular Phenomena

1 *Vasoconstriction* With any injury there is stimulation of the vasomotor system and resultant vasoconstriction. This is usually a transient disturbance which may be manifest clinically by blanching of the skin, cooling of the wounded part and emptying of the veins This phenomena is most readily demonstrated in those with dermatographia.

2 *Vasodilatation* With vasoconstriction there is a decrease

in blood flow but the demand for blood in the area of injury causes release of the smooth muscle vasomotor system and capillary dilatation occurs This is a passive mechanism in which the capillary bed in the area of reaction opens and fills as a sponge Clinically this may be observed as redness and an increase in local heat If vasodilatation is extensive or generalized, fainting may occur, or the more profound reaction of shock may be initiated

3 *Increase in capillary permeability* Following irritation, vasoconstriction, and vasodilatation, there occurs a reversible alteration in normal capillary filtration exchange In the terms of Claude Bernard this is a disturbance of the "milieu interne" In this disturbed state, leukocytes as well as the substances in the fluid portion of the blood pass through the walls of the capillaries As the blood flow becomes sluggish with vasodilatation, the leukocytes tend to fall out of the central core of the bloodstream and move to the periphery of the flow Here their movement becomes even slower and they stick, partly due to substances on their surfaces and also due to the irregularity and protrusion of the endothelial cells that line the vessels The inner walls of the capillaries thus become lined with leukocytes These vessels soon become permeable enough to permit diapedesis of leukocytes and selective passage of fluids, proteins, and electrolytes The mechanisms of capillary dilatation and increased permeability may be due to substances released from injured tissue Menkin has described a substance such as this, which he calls "leukotaxine" He has shown that this material will produce increased capillary permeability and leukopedesis, when applied to uninjured tissue With increased capillary permeability swelling occurs, intercellular and intracellular fluid and electrolyte balance is disturbed, and leukocytes migrate into the injured tissues Clinically the outpouring of fluid results in edema with increased tissue tension and pain With these events neutralization or fixation of the irritant force has begun

B EXUDATE

1 *Lymph* Soon after injury there is an increase in lymph flow from the area of injury This is probably responsible for the reactive state of the host to his wound in the early hours after

injury Through this flow of lymph the local reactors found in injured tissue may easily produce disturbances such as fever leukocytosis, and increased capillary permeability These distress signals demand the mobilization of supplies that are needed in the area of injury Soon after the formation of the exudate fibrin is deposited in the wound and its effluent lymphatic channels which results in wound blockade and relative isolation of the wound from the body

2 *Blood* If blood vessels which are not too large are injured or divided the ensuing hemorrhage will usually cease spontaneously and the products of shed blood become an essential part of the exudate Bleeding stops due to (1) extravascular tissue tension and contractility (2) vascular stimulation at the point of injury and resultant contraction and retraction of the vessel and (3) intravascular damage to the intima which attracts the platelets and initiates the formation of the hemostatic plug Tocantins has pointed out that these same physiologic reactions are imitated by surgeons in their attempt to control hemorrhage by measures such as pressure dressings ligatures or the administration of agents such as vitamin K

3 *Electrolytes* Locally at the point of injury there is accumulation of potassium and calcium in the exudate of the extracellular spaces and a decrease in sodium and chloride This shift is probably of little relative importance early but prolonged imbalance may evoke considerable disturbance

CATABOLISM

A. Wound Clearing

Exudate provides the medium in which neutralization of the irritant occurs and damaged tissue is eliminated Exudate varies considerably with the type of irritant When the irritant is bacterial the exudate is largely composed of leukocytes or pus cells If the injury is caused by physical force such as a laceration, the exudate is complex and may contain cellular debris and whole blood in addition to lymph, cellular fluid and leukocytes Exudate varies with the duration of injury and the progression of phenomena. In the acute inflammatory exudate, polymorphonuclear leukocytes predominate, for they are the first line of

defense. Later the macrophages will make their appearance and the leukocytes will disappear.

B. pH

At the time of its formation, the pH of exudate is quite similar to that of body fluids from which it is derived, or about 7.2 to 7.4. At this point, bacteria may exist in great numbers and the characteristic cell of the exudate is the polymorphonuclear leukocyte. With wound blockade there is lack of oxygen, and continued activity becomes dependent upon anaerobic glycolysis or the conversion of sugar to lactic acid. The accumulation of acid results in a decrease in pH with a gradual disappearance of bacteria and polymorphonuclear white cells and the appearance of macrophages. Reduction in pH is probably one of the more important pain-producing factors. With a drop in pH to 6.5 or 6.0, collagen softens, cellular debris tends to liquefy and leukocytes die. This gives rise to pus, which virtually is made up of dead cells. With completion of catabolism, exudate may be discharged on the surface or absorbed, detoxified by the liver, and eliminated through the kidneys. With the elimination of necrotic material the pH begins to rise, and when it nears the normal value the first evidences of repair become manifest and pain lessens. The course of pH can be followed closely in wounds by means of paper indicators. Use of pH in this manner is a most useful guide in determining when a wound should be closed either by suture or skin graft.

C. Wound Metabolism

The metabolism or oxygen uptake of a wound will become slightly elevated with inflammation but soon tends to fall due to wound blockade. It reaches its lowest point during the catabolic stage. Metabolism gradually returns to normal with the start of repair. During this period a state of increased metabolism exists. Normalcy is not restored until the phase of contracture, after healing, has been attained.

REPAIR

A. Phases of Repair

Repair is dependent upon cytoblastic cellular activity. Basically

this is concerned with fibroblastic activity and epithelial growth Wound healing occurs in phases described as follows

1 *Lag Phase* Wound repair includes the stages of inflammation and catabolism, for the mechanism of repair must await cleaning of the wound by autolysis heterolysis phagocytosis and absorption During this time, the living tissues of the wound are in a quiescent state with metabolism and pH depressed This is the lag phase which in a clean surgical wound may be as short as 24 hours though usually it is from 3 to 5 days During the lag phase a sutured wound has no strength therefore, sutures should not be removed during this period In an open wound containing slough, the lag phase may last for months The excellence of surgical technic is directly related to the length of the lag phase.

2 *Phase of Fibroplasia* When the wound has been cleared of debris, the fibrin deposited by exudate will supply the matrix upon which healing will proceed The first evidence of repair is budding of capillaries into the fibrin network which is accompanied by proliferation of fibroblasts Fibroplasia occurs by mitotic and amitotic cellular division and migration takes place by flowing and by ameboid motion The cells that contribute to this are (1) the mesenchymal cells or pericytes (2) the ameboid cells such as the lymphocytes (3) the macrophages and (4) the fibroblasts As the capillary buds grow they become branched and surrounded by fibroblasts These small centers of activity later tend to coalesce, but as they stand in early growth they present a pebbled or granular appearance hence the term granulation tissue With the formation of granulation tissue leukocytes disappear pH becomes elevated metabolism increases pain lessens and the loss of protein and other substances into the wound decreases Granulation tissue is impervious to many substances which are irritating to freshly exposed tissue A granulating surface is further protective in that it exudes a mucoid substance which may be quite resistant to bacterial activity Granulation tissue is scar tissue in a lush phase of existence which in open wounds will fill defects and present a surface suitable for epithelization.

Between the tenth and fourteenth day of clean wound healing there occurs an important step in regeneration—fibrillization The

fibroblasts, which up to this time have been loosely arranged large cells, quickly form fibrils, which interlace to give strength to the tissue Thus the wound begins to assume the strength of the adjacent tissues The source of these collagen fibrils is in doubt but it is likely that they originate either from the fibroblasts or from the ground substance

3 *Contracture Phase* As fibroplasia reaches completion, as evidenced by fibrillization, the wound begins to assume strength which is manifested by contracture This approximates wound edges and squeezes closed many of the capillaries in the newly formed tissue There is resultant decrease in blood flow and metabolism The contracture phase may be described as one of avascular organization

Epithelization In clean surgical wounds in which tissue layers have been accurately reapproximated, epithelial union may be established within 24 hours If approximation is inaccurate, it may be several days before the wound is sealed In open wounds, epithelial repair occurs during the early part of the contracture phase Its start becomes evident when the sharp wound edges disappear Under ideal conditions, epithelial coverage of an open, granulating wound occurs rapidly in spurts in tonguelike projections, which originate from the cells of the malpighian layer Clinically, this may be observed as a blue-gray line around the circumference of the wound defect Without adequate blood supply epithelial growth is retarded or may cease, in which case an ulcer exists Epithelium usually does not "grow uphill" or on boggy or exuberant granulation tissue (proud flesh), therefore, this tissue must be removed for healing to occur Similarly, epithelium is not likely to grow into a crater defect, probably because a wound that cannot fill its defect with granulation tissue is relatively avascular and unhealthy The early coverage of the wound with a thin layer of epithelial tissue is soon followed by thickening and hyperplasia

4 *Definitive Phase* In time, contracture will lessen, induration will subside and the scar will soften However, scar will always remain scar and will not assume the functional qualities of any tissue other than those that originate from the same prototype—the fibroblast

RATE OF WOUND HEALING

Wounds heal at a normal optimal rate, dependent upon the age of the patient and the size of the defect If these variants are considered the rate of healing can be predicted by the algebraic formulas evolved by DuNouy and Carrel Any attempt to hasten wound healing must be directed either toward reduction of the lag phase or increasing the speed of fibroplasia The lag phase of inflammation and catabolism may be reduced by the surgical removal of foreign matter and damaged tissues This is the basic premise of good surgical wound physiology While many agents have been introduced such as vitamin preparations, tissue extracts and various chemicals for which stimulation of healing is claimed there are no circumstances known whereby a wound may be made to heal at a speed greater than the normal optimal rate In order to increase this optimal rate of repair it would be necessary to increase the rate of mitosis during fibroplasia If this were possible, neoplasm could be produced which would be a great advance in the study of malignancy It should be understood that *nothing* stimulates the healing of a wound though many things will impede the progress of healing

FACTORS WHICH ALTER NORMAL REPAIR

The factors which interfere with normal tissue repair can be classified as general, nutritional, and local Though some may be constitutional and some irreversible, good surgical management may correct or eliminate these deterring factors so that normal healing may proceed

A General Factors

1 *Age* It is generally believed that children heal faster than adults Studies have shown that in young rats the lag phase is shorter and fibroplasia starts earlier This advantage was nullified partly by the fact that fibroplasia continued longer in the young Clinically children tend to heal faster but are more inclined to overheal, with resultant scar hypertrophy

2 *Other Factors* When such conditions as agammaglobuline-

mia, collagen dysplasias, diabetes, and arteriosclerosis are present they alter the expected rate of healing Before local conditions are blamed, the factors of general disturbance must be determined

B Nutritional Factors

Proteins are essential to wound healing but it is extremely difficult and perhaps unnecessary to maintain a positive protein balance in a postoperative patient However, if wound healing and convalescence is prolonged, protein deficiencies become vitally important Since there is loss of protein in the form of blood at the time of injury or operation, accumulation of protein in the wound, and seepage of protein substances from open lesions, it becomes evident that a wound acts as a parasite Nutritionally, it will take precedence over all other body economy An established protein deficiency has been found to increase the lag phase, prolong the phase of fibroplasia, and lessen the tensile strength of healing In addition, protein deficiencies result in lowered resistance to infection Carbohydrates and fats are essential to maintain total body metabolism and to support tissue undergoing repair, therefore, a well-balanced diet, preferably by mouth, should be provided all patients postoperatively, as soon as it can be tolerated Parenteral routes of nutritional therapy have not been found to be as advantageous as oral feedings, although they must be used frequently

Of the many vitamins, ascorbic acid and riboflavin have been found to exert the greatest influence on wound healing Both these substances encourage wound strength Vitamin C deficiency decreases the strength of fibrils, slows the rate of capillary growth, and lessens wound resistance to infection

C Local Factors

1 *Inherent Local Factors*·
(a) Necrotic tissue
(b) Foreign bodies
(c) Continued irritation
(d) Circulatory deficits
(e) Infection

The disturbance in repair created by necrotic tissue, foreign substances, and continued irritation are usually amenable to debride

ment and immobilization Circulatory deficits may be impossible or difficult to improve significantly Infection is the greatest problem in wound management. It is best managed by prevention which includes the early removal of necrotic tissue and maintenance of good wound physiology

2 *Surgical Factors* The local factors listed above may exist to some degree in every wound, but by surgical trauma we may add to the burdens of repair Heavy suture material used to ligate large masses of tissue produces a foreign body reaction associated with necrotic tissue A wound closed under too much tension may interfere with circulation in the tissues A closed wound which leaves a dead space lends itself to complications such as hematoma formation infection drainage breakdown additional loss of tissue, and extensive scarring Every surgical procedure should be designed to add as little as possible to the burden of wound healing

CLASSIFICATION

The healing of wounds is classified as follows

A. *Healing by First Intention* This is the prompt uncomplicated healing of a clean, sutured wound

B *Healing by Delayed Primary Suture* This expression was introduced by Churchill from North Africa during World War II and describes the healing of a wound sutured 3 to 10 days after injury and evacuation These wounds though contaminated had been debrided and were closed on the basis of their clinical appearance If healing was satisfactory and uncomplicated the wound was considered healed by primary suture

C. *Healing by Secondary Intention* In this category the wound is left open or there is usually loss of substance so that the wound heals by granulation tissue contracture and epithelization

D *Healing by Third Intention* This term is used to describe a wound that breaks down (dehiscence) and is secondarily sutured to heal without further complication

SUTURES

Suture material may be absorbable or nonabsorbable In general, the absorbable sutures are more irritating to the tissues than

the nonabsorbable, but they cause less clinical concern in the event of infection Absorbable suture is made from the submucosa of sheep intestine and is produced in plain and chromicized forms The plain gut is absorbed more rapidly and is therefore the more irritating of the two Nonabsorbable sutures are principally of silk, cotton, or steel wire, all are less reactive in wounds than gut suture In the event of wound infection with nonabsorbable sutures, drainage may be prolonged, with extrusion of these bits of foreign substance

Each type of suture has its place in surgical therapy Absorbable sutures are indicated in the presence of gross contamination of wounds, where the likelihood of infection is great They are particularly useful in epithelial repair of hollow viscera Nonabsorbable sutures can be used in almost any tissue but on epithelial surfaces they must be removed or they act as persistent foreign bodies Silk is the most widely accepted nonabsorbable suture, though cotton is cheaper and more easily procured Wire suture, both monofilament and multifilament, has been used extensively Wire is somewhat difficult to tie, which is an encumbrance that frequently exceeds its value Wire is the least irritating of any suture material

All sutures are graded in terms of their tensile strength Suture material that is too heavy should be avoided, for the foreign body reaction is proportional to the bulk of foreign material

The objective of wound suture is the accurate approximation of the tissues without tension This is best achieved by small sutures placed close together near the wound edge Large sutures which strangle a mass of tissue are undesirable because they interfere with blood supply and wound healing Unless contraindicated, wounds should be closed in layers with sutures applied to peritoneum or pleura, fascial layers, and skin Muscle sutures are of little value There are many suture technics such as horizontal and vertical mattress sutures, a great variety of continuous stitches, and the simple interrupted stitch

Sutures are used to close wounds in order to maintain tissue integrity In clean surgical wounds, sutures provide all the strength for approximately two days until the fibrin of exudate has been deposited to seal the wound After this, the tissue strength increases and need for suture strength decreases By the

tenth to the fourteenth day when fibrillization has occurred wound strength exceeds suture strength and the sutures become unnecessary and troublesome foreign bodies The rate of repair of clean wounds varies with the tissue involved and its blood supply If a few supportive buried sutures have been used the skin stitches can be removed as follows

1 Scalp—third to fourth day
2 Face—fourth to fifth day
3 Eyelids—second day
4 Horizontal neck incisions—second day
5 Vertical neck incisions—fourth to fifth day
6 Chest and abdomen—fifth to sixth day
7 Extremities—sixth day
8 Palmar surface of hand—tenth day
9 Plantar surface of foot—tenth day

DRESSINGS

Dressings should be applied to wounds only if they accomplish a useful purpose Wound dressings provide protection absorptive covering, pressure splinting, and, last but not least comfort If the zone of surgery is deep within the body, dressings serve little purpose except as an absorptive medium. The more superficial the area of injury or surgical procedure the more necessary and elaborate the dressing becomes

Almost without exception the best dressing is that applied immediately after operation with the patient anesthetized Such a dressing is done with the most adequate facilities and the patient is in a passive, painless state This dressing should not be removed until there is some specific indication for wound therapy Any inspection of the wound to satisfy curiosity is unjustified The indications for early wound inspection include drainage pain, odor or a systemic disturbance that may be caused by a wound complication In closed wounds dressings should be changed for the removal of drains packs or sutures

Surgical dressings should be done with gentleness and care to avoid pain While this is important in all surgery it is most important in pediatric surgery for children cannot appreciate any cause for pain Tape should be removed gently so the epithelium

is not pulled away Strong, irritating solutions should not be employed except when essential The change of dressings over a closed wound should be relatively nontraumatic

In open wounds the element of trauma or debridement by gauze dressings may play a significant part in therapy However, this can be a relatively comfortable procedure if gauze, kept moist with saline, is used and changed every 8 hours, for 2 to 3 days Subsequently, or after granulation tissue has formed, daily dressings with dry or greasy fine-mesh gauze can be applied with relative comfort These dressings aid in the removal of slough and serve to prepare open wounds, such as burns, for skin grafting

DRAINS

Only positive suction-type drains actually remove fluid from a body cavity or space Wick drains of rubber, plastic, or fabric act as foreign bodies With a drain in the peritoneal cavity, the surgeon selects the site at which he wishes the reaction of localization to occur A drain is a foreign body which maintains a state of *locus minoris resistencea,* in that it attracts to it the processes of foreign body neutralization There are three principal indications for the use of drains in the body cavities

1 An open viscus
2 Necrotic tissue or pus
3 Uncontrollable bleeding

In areas where open anatomic spaces do not exist, the only indication for drains are those associated with necrotic tissue or pus

WOUND COMPLICATIONS

A INFECTION

1 *Causes* There are three essential prerequisites for the occurrence of infection

(a) A susceptible host
(b) A suitable portal of entry
(c) A pathogenic organism

Any wound will serve as a suitable portal of entry for bacteria but infections seldom occur in clean surgical incisions that have

been gently and accurately approximated. Infection is seldom a spontaneous process, but rather one that develops as a result of some pre-existing disturbance Wound infections are usually superimposed upon and reflect an underlying disturbance in wound physiology such as retained necrotic tissue or foreign substance, closure under tension or closure over a dead space The etiologic organisms of wound infections are most frequently Streptococci, Staphylococci and Clostridia In accidental injuries the etiology of infection is complicated by the factors of contamination Sir Alexander Fleming demonstrated in World War I that military wounds were contaminated with essentially the same distribution in flora that exists in feces Altemeier has shown this to be true in civilian accidental injuries in which the contamination is chiefly derived from the patient s skin and clothing

2 *Clinical Findings in Wound Infections* Often the first clinical evidence of wound infection will be obtained from the patient who complains of pain in the wound Subsequently systemic disturbances occur with elevation of temperature and pulse and general malaise Locally there will be an area of erythema about the wound with swelling and abnormal tenderness The removal of one or two sutures may reveal a drop of pus that can be cultured for the etiologic organism. At this stage, the infection is most likely monobacterial

Hemolytic Streptococci produce a great variety of clinical infections such as cellulitis impetigo lymphadenitis and erysipelas All these diseases are characterized by an acute onset and profound systemic reaction This is also true in wound infections These infections usually subside promptly with adequate antibiotic therapy and with little or no evidence of architectural destruction of the tissues

Hemolytic Staphylococcus aureus infections present a different clinical picture in which the onset may be more gradual with less systemic disturbance Staphylococcic infections do not spread along tissue planes but cause great architectural destruction and usually lead to abscess formation

3 *Treatment* Patients with infected wounds should receive prompt and specific antibiotic therapy Drainage should be established only if there is a collection of pus Local applications of heat or cold may be used for comfort and to aid in drainage.

B ABSCESS

1 *Findings* An abscess occurs when dead tissue becomes liquefied to form pus within a protective wall of resistance Pus is characterized by polymorphonuclear leukocytes and is made up of liquefied exudate containing cellular debris, dead leukocytes, and living and dead bacteria Usually an abscess will drain to the surface but occasionally they are absorbed Clinically, an abscess presents a painful, shiny, tense, fluctuant swelling

2 *Treatment* · The preferred treatment of any abscess is surgical drainage, specific antibiotic therapy, and supportive measures as needed Antibiotics should not be used as a substitute for drainage In draining an abscess, the opening should be wide enough to permit complete evacuation and subsequent packing of the defect with gauze The packing is gradually withdrawn in the ensuing two to four days

C DEHISCENCE AND EVISCERATION

1 *Causes.* The cause of wound disruption, or dehiscence, and evisceration are the same, for evisceration is the visceral continuation of wound disruption This is a dramatic, painful, and sometimes extremely shocking experience The causes for wound disruption are malnutrition, anemia, massive hemorrhage, defective suture material, sensitivity to suture material, inadequate hemostasis, midline vertical incision, violent postoperative straining such as coughing, vomiting, or sneezing, and marked distention

Dehiscence or evisceration is an uncommon, abrupt event that occurs on about the seventh postoperative day The patient will usually state that something in the wound gave way Soon after this, fresh serosanguineous drainage appears on the bandage or evisceration may be apparent

2 *Treatment* Prepare immediately to treat the patient for shock by transfusion and supportive measures, which, in the event of evisceration, should include the insertion of a tube through the nose and into the stomach for decompression As soon as the patient's condition will permit, the defect should be repaired under anesthesia, with through-and-through wire retention sutures If the patient's condition is poor, then immediate

strapping together with adhesive tape should afford ample support until more definitive measures can be employed

The best treatment is to correct malnutrition preoperatively if possible Use an oblique or transverse incision, close securely support the abdomen and control repeated straining acts

D HEMATOMA

1 *Cause* The causes of hematoma formation are inadequate hemostasis poor pressure dressing and unexpected elevation in blood pressure A hematoma affords an excellent medium for the development of an infection

2 *Treatment* Treatment should depend on the size of the hematoma. If small it may be preferable to permit the hematoma to absorb If there is seepage between sutures or any breakdown in the hematoma, it should be evacuated

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CHAPTER 7

Oxygen Therapy

JOSEPH H MARCY

I OXYGEN ADMINISTRATION

FEW FORMS OF THERAPY in medicine are so misunderstood as the administration of oxygen Needless and ineffective use of oxygen results in tremendous waste and expense Certainly no patient should be denied the administration of supplemental oxygen if there is the slightest question of hypoxia however an attempt should be made to prescribe oxygen on a rational basis

(a) Does the patient truly require oxygen?
(b) What is the cause of the hypoxia?
(c) What concentration will be required?
(d) What form of therapy will best meet the patient's needs?
(e) Does ventilation need to be assisted?
(f) Does the patient have a patent airway? Does he need a pharyngeal airway a tracheal tube, a tracheotomy?
(g) Will additional humidity be desirable?
(h) Should environmental temperature be increased or lowered?
(i) How long should therapy be continued?
(j) Will drugs such as analeptics or antidotes for opiates or curariform agents be of value?

2. INDICATIONS

The indications for oxygen therapy are as numerous and complex as the causes and types of hypoxia A full discussion of them cannot be given here Some of the more common indications in pediatric *surgical* patients are

(a) Premature and newborn infants regardless of disease process, but no longer than necessary
(b) Intrathoracic cases
(c) Patients in hypotension, shock, or circulatory failure
(d) Patients whose ventilation is depressed by drugs or anesthesia
(e) Patients with severe respiratory or cardiac disease
(f) Patients with existing airway obstruction, e g, excessive secretions, edema—or if there is reasonable fear that such may occur
(g) Patients with pathologically low hemoglobin values

3. LIMITATIONS OF OXYGEN

It is well to remember that the administration of additional oxygen itself

(a) Cannot overcome an obstructed airway
(b) Can compensate only to a limited extent for depressed respiration
(c) Does not guarantee elimination of carbon dioxide
(d) Does not hasten the removal of volatile anesthetic agents from the body
(e) Will not cause a patient to respond more quickly from anesthesia

4. EQUIPMENT AND TECHNICS

Tent This is the most useful and generally satisfactory form of oxygen administration for most pediatric patients

ADVANTAGES

(1) Environment of increased oxygen with minimum encumbrance of the patient
(2) Cooling (by ice or thermostatically controlled refrigerating unit)

(3) Circulation of air (either by electric blower or vent)

DISADVANTAGES

(1) Inefficient and expensive because of high flows of oxygen required, especially if patient requires much attendance Leakage may be considerable

(2) Apparatus is expensive to buy and costly to maintain

(3) Carbon dioxide may accumulate if flow is not kept high

TECHNIC

Flows of 15 liters per minute or more should be used for the first 20 to 30 minutes to allow filling From 10 to 12 liters per minute will be required in most tents to maintain concentrations of oxygen of around 50 per cent. This may vary considerably contingent on how tightly the tent is closed and how frequently the patient must be attended

Croup Tent This is a smaller version of the oxygen tent designed chiefly for infants and small children It supplies, in addition to oxygen and cooling, high humidity for treatment of respiratory disease Some models also provide a nebulizer which may be attached to the tent for administration of aerosol medication

Nasal Catheter

ADVANTAGES

(1) Minimal equipment

(2) Reasonably efficient use of oxygen

DISADVANTAGES

(1) Poorly tolerated by the conscious child

(2) Oxygen stream may dry or "burn" pharyngeal mucosa.

(3) May cause swallowing of air and produce gastric dilatation

TECHNIC

(1) Catheter inserted into pharynx through nose so that tip may just be seen below soft palate (usually the distance from the tragus of the ear to the ala nasi)

(2) Catheter must have multiple fine holes at tip

(3) Catheter must be changed and cleaned at frequent intervals

(4) Oxygen must be humidified

(5) From 5 to 6 liters per minute will give about 50 per cent concentration in the pharynx.

may result in substernal distress, cough, sore throat, and diminished vital capacity Although clinically the maintenance of such high concentrations is unlikely, and often actually difficult to achieve (except with a mask), the danger must be borne in mind When, however, high concentrations of oxygen must be given for the relief of hypoxia, fear of oxygen toxicity should not be a deterrent

The incidence of retrolental fibroplasia is presumed to increase with prolonged administration of oxygen to premature infants But here again if increased inspired oxygen is required to avoid hypoxia, it should not be withheld Frequent trials without additional oxygen will indicate the earliest possible time when oxygen may be discontinued safely

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SECTION III SPECIFIC PRE AND POST-OPERATIVE CONSIDERATIONS

CHAPTER 8

Abdominal

WILLIAM B KIESEWETTER

ANNULAR PANCREAS (NEONATAL)

(A) REQUIRED STUDIES

(1) History of intractable vomiting
(2) X ray supine and erect without contrast medium
(3) Blood chemistry determinations—Na, K Co₂, Cl

(B) ELECTIVE STUDY

Upper gastrointestinal series if partial obstruction only

(C) DIFFERENTIAL CONSIDERATIONS

(Academic, since intestinal obstruction demands exploration.)
(1) Atresia of duodenum.
(2) Duplication of duodenum.
(3) Malrotation of colon with or without volvulus
(4) Stenosis of duodenum

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Correction of electrolyte balance as necessary
(2) Wangensteen suction continuously with 2 cc. saline irrigations every 2 hours.

(3) Nothing by mouth
(4) Parenteral vitamins—B, C, and K
(5) Cut-down in leg for intravenous fluids

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
 a) Nothing by mouth for at least 48 hours
 b) Wangensteen suction with 5 cc injections of air every 2 hours
 c) Glucose water (10-15 cc every 2 hours initially) progressing to alacta® or nutramigen© formula gradually over 2 days
 d) Intravenous fluids till alimentation well established
 e) Keep baby on right side or on abdomen
 f) Blood or plasma daily, supportively, for first week
 g) Antibiotics—penicillin and streptomycin by weight
 h) O_2—isolette preferred
(2) *Studies*
 a) Chemistries only if vomiting
 b) If patient vomits, flat abdomen film to see if anastomosis open
(3) *Complications*·
 a) Failure of duodenojejunostomy to open up. (Concentrated albumin intravenously "Tincture of Time" Fresh anastomosis finally)
 b) Temporary jaundice secondary to ampulla of Vater edema ("Tincture of Time")
 c) Cut-down phlebitis (Soaks)

APPENDICITIS

(A) REQUIRED STUDIES

(1) History of
 a) Abdominal pain
 b) Nausea and/or vomiting
 c) Loss of appetite
(2) Physical examination
 a) Right lower quadrant tenderness, direct and rebound
 b) Right lower quadrant muscle-guarding.

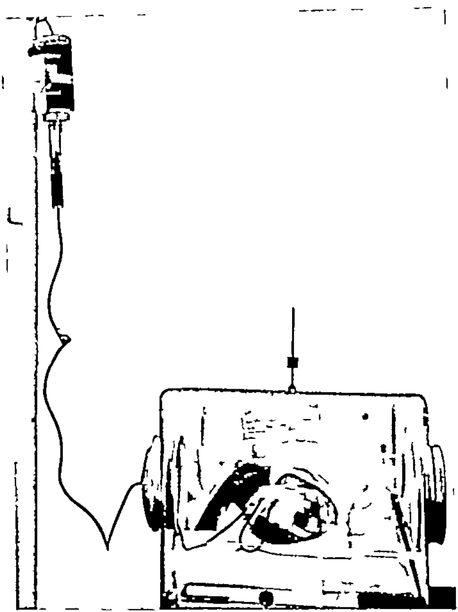

FIG. 15 —The position of choice in a postoperative infant to facilitate gastric emptying and make it safe for child to handle emesis

c) Hypoperistalsis
d) Rectal tenderness on peritoneal pull
e) Low grade fever (100-101° rectal)

(3) Complete blood count and urinalysis

(B) ELECTIVE STUDY

Chest film

(C) DIFFERENTIAL CONSIDERATIONS

(1) Gastroenteritis
(2) Meckel's diverticulitis
(3) Mesenteric adenitis
(4) Pyelonephritis
(5) Rheumatic fever
(6) Sicklemia
(7) Upper respiratory infection and pneumonia

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Correct dehydration by intravenous fluids if much vomiting has occurred
(2) Nothing by mouth
(3) Sedation and analgesia only after diagnosis clear
(4) Routine preoperative medication (see Chapter 3, p 35)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*

a) Nothing by mouth for 24 hours Then gradual liquid to soft to general
b) Wangensteen suction where ruptured appendix removed Otherwise not used
c) Irrigation of Wangensteen every 1-2 hours to keep open
d) Intravenous fluids
e) Antibiotics where ruptured Selective use in simple acute appendicitis
f) O_2 in serious peritonitis
g) Small enema (3-4 oz) on third postoperative day if no bowel movement

h) As early ambulation as condition and temperature permit.

(2) *Dressings*
Nothing special

(3) *Studies*
Chemistries where Wangensteen kept up over 48 hours

(4) *Complication*
Intraperitoneal abscess. (Intensive new antibiotics Occasionally drainage.)

BILIARY ATRESIA

(A) REQUIRED STUDIES

(1) History of
a) Jaundice in mother during pregnancy
b) Jaundice at or soon after birth
c) Dark urine and acholic stools

(2) Physical examination
a) Normally nourished infant
b) Hepatomegaly
c) Green yellow color of chronic jaundice

(3) Laboratory studies
a) Immediate and total bilirubin
b) Liver function studies
c) Stool for bile
d) Urine for bile and urobilinogen
e) Duodenal drainage for bile and pancreatic enzymes
f) Rh studies on mother and child

(B) ELECTIVE STUDIES

(1) Blood serology
(2) X rays for secondary rickets

(C) DIFFERENTIAL CONSIDERATIONS

(1) Congenital syphilis
(2) Erythroblastosis
(3) Hepatitis
(4) Inspissated bile.
(5) Neonatal sepsis
(6) Physiologic jaundice of newborn.

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Administration of cholegogue for 3-5 days with repeat duodenal drainage Cortisone preferred (2-3 mgm three times a day for 3 days)
(2) Parenteral vitamins—B, C, D, and K
(3) High protein, high CHO, low fat diet to build up liver
(4) Antibiotics immediately preoperatively
(5) Treatment of secondary anemia
(6) Routine preoperative medication (see Chapter 3, p 35)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
  a) Nothing by mouth
  b) Wangensteen suction for 24-48 hours if much dissection or anastomosis done
  c) Intravenous fluids, electrolytes, and vitamins
  d) Alimentation from water→formula low in fat
  e) Antibiotics by weight
(2) *Dressings* If cholecystostomy tube placed, hook it up to drainage
(3) *Studies*

a) Stool for bile Repeat bilirubin	if operable remnant found
b) Repeat duodenal drainage Cholecystogram at seventh postoperative day	if no operable remnant found and cholecystostomy tube placed

(4) *Complications*
  a) Bleeding from liver biopsy site (reoperate—rare)
  b) Prolonged ileus (suction drainage, O_2, nil PO)

INTESTINAL ATRESIA

(A) REQUIRED STUDIES

(1) History of
  a) Persistent vomiting since birth

FIG 16—Wangensteen continuous gastric suction employing a Gomco pump This type used at Children's Hospital of Pittsburgh, can be regulated to 90 mm. or 120 mm of mercury suction

b) Few or absent stools

(2) X ray (without contrast medium) Complete obstruction with distended loops ending abruptly and no gas below

(3) Blood chemistry determinations Na, K, Co_2, Cl

(B) ELECTIVE STUDY

Stool examination for epithelial cells (Farber's test)

(C) DIFFERENTIAL CONSIDERATIONS
(Academic, since obstruction requires surgery)

(1) Congenital bands e.g oomphalomesenteric remnant.

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Routine preoperative medication (see Chapter 3, p 35)
(2) Preparation of pubic area where indicated

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
  a) Oral fluids and diet postnausea
  b) Antibiotics not necessary
  c) Ambulatory
(2) *Dressings* Remove traction suture one week after surgery
(3) *Study* Evaluate result 4 months postoperatively
(4) *Complications* Rarely encountered

DUODENAL BANDS

(A) REQUIRED STUDIES

(1) Physical examination while sucking sugar nipple or glucose water
  a) Absence of pyloric mass, with bile-stained emeses, with or without peristaltic waves—suggestive of diagnosis
(2) Upper gastrointestinal series
(3) Blood chemistry determinations—CO_2, Cl, Na, and K
(4) Hydration estimation by urine amount and specific gravity

(B) ELECTIVE STUDY

Subdural taps where indicated

(C) DIFFERENTIAL CONSIDERATIONS

(1) C N S disease
(2) Chalasia
(3) Congenital esophageal stenosis
(4) Malrotation of colon
(5) Poor feeding habits—formula, speed, burping

(6) Pyloric stenosis
(7) Vascular ring

(D) PREOPERATIVE TREATMENT AND ORDERS

Same as for Pyloric Stenosis (p 146)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders* Same as for Pyloric Stenosis (p 146)
(2) *Complications* Rarely encountered

DUPLICATION OF INTESTINAL TRACT

(A) REQUIRED STUDIES

(1) Palpation of an abdominal mass
(2) History of intermittent partial or complete intestinal obstruction with or without melena.
(3) History of melena with or without obstruction
(4) X ray evidence stenosis obstruction, or paraintestinal mass

(B) ELECTIVE STUDY

Blood chemistry determinations if prolonged vomiting has existed

(C) DIFFERENTIAL CONSIDERATIONS

(1) Intestinal atresia.
(2) Intestinal stenosis
(3) Intussusception
(4) Inverted Meckel s diverticulum.
(5) Malrotation of colon and/or volvulus
(6) Meconium ileus

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Correction of blood electrolyte pattern where indicated
(2) Continuous Wangensteen suction where obstruction present
(3) Cut-down or intravenous fluids

(4) Intestinal preparation with sulfasuxidine and neomycin
(5) Parenteral vitamins C and K
(6) Routine preoperative medication (see Chapter 3, p 35)

(E) POSTOPERATIVE MANAGEMENT
(We assume resection was necessary)

(1) *Orders* (see Intestinal Atresia Orders, p 112) Wangensteen irrigation with saline, not air
(2) *Study* Blood chemistries as indicated by long period on suction
(3) *Complications* Rare

FISSURE-IN-ANO

(A) REQUIRED STUDIES

(1) History of difficult and painful stooling with hard, blood-stained feces
(2) Anoscopic examination

(B) ELECTIVE STUDIES

(1) Barium enema to rule out other causes for bleeding
(2) Hematologic studies ate medical cause for bleeding

(C) DIFFERENTIAL C NS

(1) Blood dyscrasia
(2) Chronic recurrent
(3) Fistula-in-ano
erted foreign bod

ATIVE TRE

f medical man.
kept soft by mi
dilatation daily
t on toilet
dicated by fail

a) Low residue diet
b) Enemas till clear the morning of operation
c) *Usual preoperative medication* (*see Chapter 3, p 35*)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
a) Liquids postnausea.
b) Stool softener (mineral oil, etc.) daily
c) Low residue diet for 10-14 days
d) Sitz baths three times a day beginning third post operative day
e) No antibiotics

(2) *Complications* Rare

FISTULA IN ANO

(A) REQUIRED STUDIES

(1) History of perirectal abscess
(2) Draining or recurrently draining perirectal sinus

(B) ELECTIVE STUDIES

(1) Chest film for tuberculosis
(2) Tuberculin skin test
(3) Smear of drainage for fungus

(C) DIFFERENTIAL CONSIDERATIONS

(1) Fungus infection
(2) Tuberculosis

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Low residue diet
(2) Cleansing enemas the morning of operation
(3) Usual preoperative medication (see Chapter 3 p 35)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
a) Liquids postnausea.

b) Stool softener (mineral oil, etc) daily
c) Low residue diet for 10 days
d) Sitz baths twice a day, beginning with first bowel movement
e) No antibiotics

(2) *Complications* · Rare

INGUINAL HERNIA

(A) REQUIRED STUDIES

(1) History of inguinal or scrotal mass
(2) Physical examination showing
a) Bulge or impulse over internal inguinal ring on increasing intra-abdominal tension
b) Thickened spermatic cord
c) Unilateral scrotal hydrocele in child over 6 months of age
d) Positive "silk sign" elicited over internal ring

(B) ELECTIVE STUDIES

None

(C) DIFFERENTIAL CONSIDERATIONS

(1) Hydrocele of cord
(2) Incarcerated ovary
(3) Lymphadenitis

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) If incarcerated
a) Preoperative medication (see Chapter 3, p 35).
b) Ice bag
c) Foot of bed elevated
d) Manual reduction after 45 minutes' sedation.
e) If successful, wait 24-48 hours before surgery, if not, proceed with emergency surgery

(2) If unincarcerated Preoperative medication

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
a) Diet as tolerated

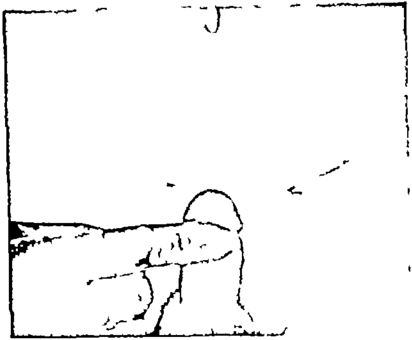

FIG. 18—Collodion type of dressing used in all herniorrhaphies Stitches are placed subcuticularly

b) Full activity as desired
c) Bath after third postoperative day (assuming subcuticular stitches used and collodion dressing)
d) Home morning after surgery

(2) *Dressings* Collodion—it will peel off spontaneously
(3) *Complications* Rare.
   a) Wound infection (hot soaks remove offending stitches drainage)

INTRA ABDOMINAL HERNIA

(A) REQUIRED STUDIES

(1) History of intestinal obstruction triad—vomiting, diminished or absent stooling, distention
(2) X rays showing intestinal obstruction
(3) Hydration estimation by amount and specific gravity of urine.

(B) ELECTIVE STUDY

Blood chemistry determinations if history of over 24 hours of vomiting

(C) DIFFERENTIAL CONSIDERATIONS

(Academic, since intestinal obstruction demands exploration)
(1) Duplication of intestine
(2) Intussusception
(3) Malrotation of colon with or without volvulus
(4) Persistence of oomphalomesenteric duct remnant

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Decompression by Wangensteen suction
(2) Correction of dehydration and electrolytes where necessary
(3) Antibiotics

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*:
a) Nil P O till peristalsis, rectal gas, or bowel movement
b) Wangensteen suction, depending on extent of procedure
c) Antibiotics
d) O_2 as aid to reducing distention from ileus
e) Intravenous fluids
(2) *Study* Blood chemistry determinations if suction used extensively
(3) *Complications*: Rare

UMBILICAL HERNIA

(A) REQUIRED STUDIES

None

(B) ELECTIVE STUDIES

None

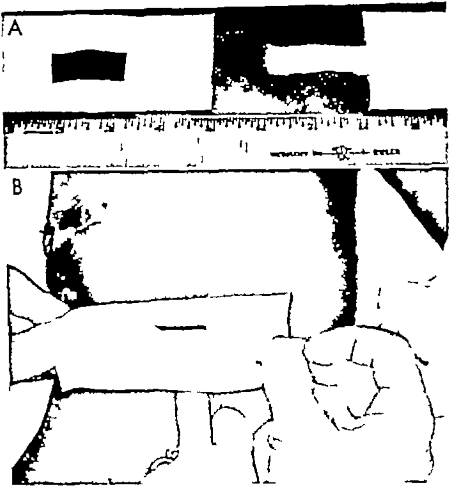

FIG 19.—*A* adhesive tape cut for use as a "truss" in umbilical hernias. *B* adhesive "truss" being applied in interlocking fashion

(C) DIFFERENTIAL CONSIDERATIONS

None

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Strapping up to 6 months of age if showing tendency to close.
(2) Routine preoperative medication (see Chapter 3 p 35)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders:*
 a) Fluids and diet as tolerated
 b) Full activity as desired
 c) Discharge 24-48 hours after operation
(2) *Dressings:* Pressure dressing if much lateral dissection and dead space created at operation
(3) *Complications* (not common)
 a) Wound infection (soaks, drainage)
 b) Recurrence (reoperate)

HYDROMETROCOLPOS (HEMATOCOLPOS)

(A) REQUIRED STUDIES

(1) History of partial urinary or rectal obstruction in neonatal female child
(2) History of pelvic pain and absent menses in an adolescent past the menarche (hematocolpos)
(3) Palpation of fixed abdominal or pelvic mass with an imperforate hymen by inspection in neonatal female child
(4) Rectal palpation of cystic mass in vagina and an imperforate hymen by inspection in adolescent girl (hematocolpos)

(B) ELECTIVE STUDIES

(1) Catheterization of bladder
(2) Aspiration of vagina through hymen
(3) X-ray injection of vagina to outline mass
(4) Cystogram or barium enema to show secondary pressure

(C) DIFFERENTIAL CONSIDERATIONS

(1) Duplication
(2) Enlarged bladder from posterior urethral valves
(3) Ovarian cyst
(4) Sacrococcygeal teratoma
(5) Urachal cyst

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Routine preoperative medication (see Chapter 3 p 35)
(2) Antibiotics

(E) POSTOPERATIVE MANAGEMENT

(We assume only hymenotomy is done)

(1) *Orders*
  a) Fluids and diet as tolerated
  b) Antibiotics
  c) Sitz baths daily for 10 days
(2) *Dressings* Keep latex catheter in vagina for several months to prevent sealing over
(3) *Complication* Hymenal stenosis and fibrosis (nothing done till premarital examination then stretching)

HYPERSPLENISM

(A) REQUIRED AND ELECTIVE STUDIES

These are varied and require an expert hematologist and surgeon working as a team

(B) DIFFERENTIAL CONSIDERATIONS AND INDICATIONS FOR SURGERY

(1) Primary hypersplenism
  a) Hemolytic anemia.
    i) Congenital—splenectomy curative
    ii) Acquired—splenectomy helpful occasionally
    iii) Sicklemia—splenectomy reduces crisis incidence in selected cases
  b) Thrombocytopenia—splenectomy helpful if steroids fail
  c) Neutropenia—splenectomy helpful.
  d) Pancytopenia—splenectomy helpful
(2) Secondary hypersplenism
  a) Portal hypertension—splenectomy only if combined with porto-caval or splenorenal shunt
  b) Gaucher s—splenectomy for size only

(3) Congestive splenomegaly
  a) Cooley's—splenectomy when transfusion requirement increases

(C) PREOPERATIVE TREATMENT AND ORDERS

(1) Adequate blood level by fresh blood transfusion within 24 hours of surgery Fresh blood at op table
(2) At least 5 days' freedom from steroid therapy
(3) Cut-down or large bore intravenous needle

(D) POSTOPERATIVE MANAGEMENT

(1) *Orders*
  a) Nothing by mouth for at least 24 hours Wangensteen drainage as indicated
  b) Fresh blood and fluids intravenously
(2) *Dressings* Remove drain from splenic fossa in 72 hours
(3) *Study* Platelet counts on first, fifth, and eighth postoperative days
(4) *Complications*
  a) Hemorrhage (drain gives early indication of this re-explore postoperatively)
  b) Thrombosis (platelets over 1,000,000 indicate anticoagulants)
  c) Wound evisceration (through-and-through sutures at secondary exploration)

IMPERFORATE ANUS

(A) REQUIRED STUDIES

(1) Physical examination
  a) No anal opening or an aberrantly placed opening (vagina or perineal body)
  b) Rectal examination in case of stenosis or atresia of lower rectum above anus
(2) X-ray
  a) In upside down position
  b) At 12-18 hours of age (no gas has time to get to rectum before this)

c) To measure distance from blind bowel to anal dimple (choice of perineal or abdominoperineal approach depends on this)

(3) Laboratory Urinary sediment examination for meconium, indicating rectourinary fistula.

(B) ELECTIVE STUDIES

None

(C) DIFFERENTIAL CONSIDERATIONS

Few except where normal anal opening is present but imperforate portion is a couple of centimeters up This must be distinguished from a tight stenosis

(D) INDICATIONS FOR TYPES OF PROCEDURE

(1) Colostomy
 a) Child under 6 pounds
 b) Hospital where infant surgery and anesthesia infrequently done
 c) Child with associated congenital anomalies

(2) Perineal approach Child where distance from bowel to anal dimple is 1 5 cm or less

(3) Abdominoperineal approach
 a) Child over 6 pounds with greater than 1 5 cm. distance between bowel and anal dimple
 b) Child with rectourinary fistula or where presence or absence of fistula cannot be clearly defined

(E) PREOPERATIVE TREATMENT AND ORDERS

(1) Parenteral vitamins—C and K.

(2) Wangensteen suction with irrigation every 2 hours with 2 cc of saline

(3) Cut-down in the arm.

(4) Catheter in bladder

(F) POSTOPERATIVE MANAGEMENT

(1) *Orders*
 a) Intravenous fluids till peristalsis returns or gas passes per rectum.

(3) When barium enema gives incomplete or questionable reduction

(E) PREOPERATIVE TREATMENT AND ORDERS

(1) Hydration and electrolyte correction quickly as needed
(2) Blood if patient in shock
(3) Cut-down or intravenous
(4) Routine preoperative medication (see Chapter 3, p 35)

(F) POSTOPERATIVE MANAGEMENT

(1) *Orders*
  a) Without resection
    i) Nothing by mouth for 24 hours
    ii) Liquid to low residue diet thereafter
    iii) Antibiotics
    iv) Intravenous fluids till good alimentation present
  b) With resection
    i) Nothing by mouth, Wangensteen suction and irrigation of tube every 2 hours with saline
    ii) Antibiotics
    iii) Intravenous fluids
(2) *Study* Blood chemistries when long suction drainage required
(3) *Complications*
  a) Recurrence—unusual (1-2%) (reoperate and tack last 12 inches of ileum along ascending colon)
  b) Diarrhea (symptomatic)

LABIA MINORA ADHESIONS

(A) REQUIRED STUDY

Physical findings of fused labia minora with small opening just below clitoris for urination and menstruation

(B) ELECTIVE STUDIES

None

(C) DIFFERENTIAL CONSIDERATIONS

(1) Imperforate hymen
(2) Intersex

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Usually simple separation with fingers or probe without anesthesia is sufficient
(2) If an operative procedure is necessary routine pre operative medication (see Chapter 3 p 35)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
  a) Petrolatum gauze wick in introitus to keep labia apart
  b) Daily cleansing care and separation of labia till epi thelization complete
  c) Bland ointment applied locally
(2) *Complication* Readherence (surgical separation)

MALROTATION OF COLON

(A) REQUIRED STUDIES

(1) History of
  a) Complete intestinal obstruction triad—vomiting few or absent stools distention
  b) Partial obstruction with low grade periodic vomit ing and failure to gain weight
(2) X rays Upper gastrointestinal series for duodenal obstruction.
(3) Blood chemistry determinations
(4) Estimation of hydration by amount and specific gravity of urine.

(B) ELECTIVE STUDY

(1) Barium enema

(C) DIFFERENTIAL CONSIDERATIONS

(1) Annular pancreas
(2) Central nervous system disease
(3) Chalasia.
(4) Duodenal bands

FIG 20—A cut-down in the greater saphenous vein, utilizing polyethylene tubing

(5) Meconium ileus
(6) Poor feeding habits
(7) Pyloric stenosis
(8) Volvulus

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Electrolyte and fluid correction as indicated
(2) Cut-down in vein
(3) Antibiotics
(4) Parenteral vitamins—C and K
(5) Wangensteen suction with 2 cc saline injections every 2 hours

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders* See Intestinal Atresia Orders, p 112
(2) *Study* Blood chemistries as indicated
(3) *Complication* Incomp[illegible]val of obstructing bands with continued obst[illegible]erate)

MECKEL S DIVERTICULUM

(A) REQUIRED STUDIES

(1) History of
   a) Painless rectal bleeding in volume (bleeding Meck el s)
   b) Or painful midabdominal peritoneal irritation sim ulating appendicitis (diverticulitis)
   c) Or episodic, painful colicky obstruction with vom iting and diminished stools (inverted diverticulum with obstruction)

(2) Rectal examination with attachment between bowel and umbilicus (more often absent than present diagnostic only when present)

(3) Red blood count and hemoglobin

(4) Stool examination for blood

(B) ELECTIVE STUDIES

(1) Gastrointestinal series and small bowel pattern (rarely productive)

(2) Blood coagulation studies

(C) DIFFERENTIAL CONSIDERATIONS

(1) Appendicitis

(2) Blood dyscrasia.

(3) Hemangioma of bowel

(4) Intussusception

(5) Mesenteric adenitis

(6) Peptic ulcer

(7) Volvulus

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Blood replacement by packed cells or whole blood

(2) Cut-down for blood and fluid replacement

(3) Routine preoperative medication (see Chapter 3 p 35)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
  a) Nothing by mouth for 24-48 hours, gradual build up by oral alimentation thereafter
  b) Intravenous fluids and blood as needed
  c) Antibiotics
  d) Low residue diet for several weeks

(2) *Complications* Uncommon

MECONIUM ILEUS

(A) REQUIRED STUDIES

(1) History of distention and vomiting
(2) Palpation of masses in the intestinal loops.
(3) Chest and abdominal x-rays
  a) Intestinal obstruction or pneumoperitoneum pattern
  b) "Stringy" patches of cystic fibrosis in lungs
  c) Adult fecal shadows in newborn
  d) "Ground glass" appearance of fecal shadows showing calcification

(B) ELECTIVE STUDIES

(1) History of other newborn siblings dying of "intestinal obstruction"
(2) Stool tested on x-ray film for enzyme activity
(3) Blood chemistry determinations—Cl, CO_2, Na, and K

(C) DIFFERENTIAL CONSIDERATIONS

(1) Duplication of intestine
(2) Inspissated colonic feces
(3) Intestinal atresia
(4) Malrotation of colon and/or volvulus.
(5) Megacolon

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Saline enema and colonic irrigations to rule out inspissated feces
(2) Correction of fluid and electrolyte balance as necessary

(3) Parenteral vitamins—C and K.
(4) Cut-down and intravenous fluids.
(5) Wangensteen suction with 2 cc saline irrigations every 2 hours

(E) POSTOPERATIVE MANAGEMENT

If Mikulicz ileostomy

(1) *Orders*
  a) Nothing by mouth
  b) Wangensteen suction and 2 cc. saline irrigations every 2 hours
  c) Intravenous fluids for 48 hours
  d) Alimentary build up and oral pancreatin
  e) Antibiotics.
  f) Silicone paste to abdomen around ileostomy
  g) O_2—isolette preferred

(2) *Dressings*
  a) Remove ileostomy clamps 24 36 hours postoperatively
  b) Irrigate both loops ileostomy with 1% pancreatin daily
  c) Apply crushing spur to ileostomy at 3-5 days and close ileostomy by 10-14 days if possible

(3) *Studies*
  a) Daily blood chemistries to plot fluid and electrolyte therapy
  b) Duodenal drainage for enzyme activities before child leaves hospital

(4) *Complications*
  a) Bronchopneumonia (O_2, heavy antibiotics humidity)

If resection or ileotomy with irrigation

(1) *Orders* Same as above, but no silicone paste necessary
(2) *Studies* Same as above
(3) *Complications* Same as above

(F) LONG TERM POSTOPERATIVE PROGRAM

(1) Diet Low fat high protein high carbohydrate high caloric.
(2) High vitamin intake

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
- a) Nothing by mouth for 24-48 hours, gradual build up by oral alimentation thereafter
- b) Intravenous fluids and blood as needed
- c) Antibiotics
- d) Low residue diet for several weeks

(2) *Complications* Uncommon

MECONIUM ILEUS

(A) REQUIRED STUDIES

(1) History of distention and vomiting
(2) Palpation of masses in the intestinal loops
(3) Chest and abdominal x-rays
- a) Intestinal obstruction or pneumoperitoneum pattern
- b) "Stringy" patches of cystic fibrosis in lungs
- c) Adult fecal shadows in newborn
- d) "Ground glass" appearance of fecal shadows showing calcification

(B) ELECTIVE STUDIES

(1) History of other newborn siblings dying of "intestinal obstruction"
(2) Stool tested on x-ray film for enzyme activity
(3) Blood chemistry determinations—Cl, CO_2, Na and K

(C) DIFFERENTIAL CONSIDERATIONS

(1) Duplication of intestine
(2) Inspissated colonic feces
(3) Intestinal atresia
(4) Malrotation of colon and/or volvulus
(5) Megacolon

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Saline enema and colonic irrigations to rule out inspissated feces
(2) Correction of fluid and electrolyte balance as necessary

(3) Parenteral vitamins—C and K.
(4) Cut-down and intravenous fluids.
(5) Wangensteen suction with 2 cc saline irrigations every 2 hours

(E) POSTOPERATIVE MANAGEMENT

If Mikulicz' ileostomy

(1) *Orders*
- a) Nothing by mouth
- b) Wangensteen suction and 2 cc saline irrigations every 2 hours
- c) Intravenous fluids for 48 hours
- d) Alimentary build up and oral pancreatin
- e) Antibiotics
- f) Silicone paste to abdomen around ileostomy
- g) O_2—isolette preferred

(2) *Dressings*
- a) Remove ileostomy clamps 24 36 hours postoperatively
- b) Irrigate both loops ileostomy with 1% pancreatin daily
- c) Apply crushing spur to ileostomy at 3 5 days and close ileostomy by 10 14 days if possible.

(3) *Studies*
- a) Daily blood chemistries to plot fluid and electrolyte therapy
- b) Duodenal drainage for enzyme activities before child leaves hospital

(4) *Complications*
- a) Bronchopneumonia (O_2, heavy antibiotics, humidity)

If resection or ileotomy with irrigation

(1) *Orders* Same as above, but no silicone paste necessary
(2) *Studies* Same as above
(3) *Complications* Same as above

(F) LONG TERM POSTOPERATIVE PROGRAM

(1) Diet Low fat high protein high carbohydrate, high caloric.
(2) High vitamin intake

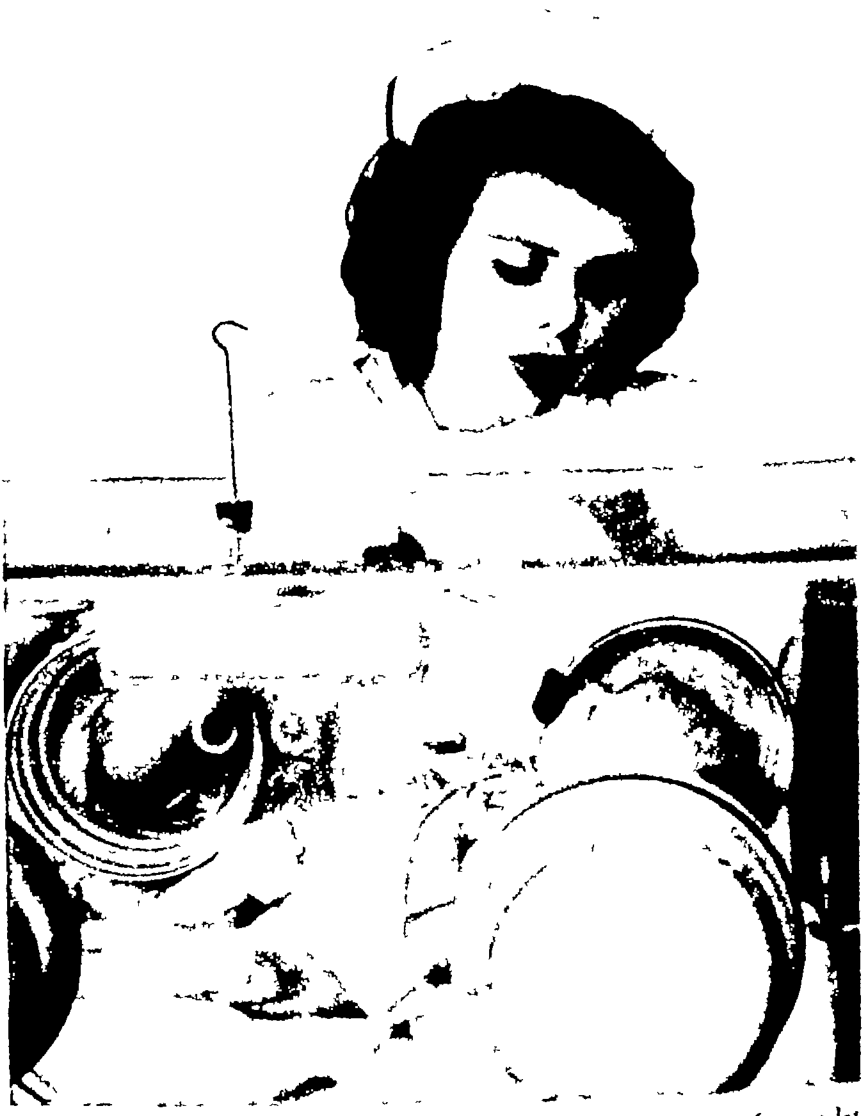

FIG 21 —An isolette—the best type of incubator for the infant undergoing surgery Temperature, position, humidity, and cross infection can be well regulated

(3) Oral enzymes
  a) Pancreatin (0.5 Gm./bottle or 1.0 Gm. before meals in older child)
  b) Viokase (1/8 teaspoonful/bottle or 1/4 teaspoonful before meals in older child)
(4) Broad spectrum antibiotics prophylactically

MEGACOLON

(A) REQUIRED STUDIES

(1) History of constipation from birth or frank intestinal obstruction at birth
(2) Palpable fecal masses
(3) Careful low barium enema to show dyskinetic segment with megacolon above
(4) If diagnosis not clear by (1), (2) and (3), internal rectal sphincter biopsy for ganglion cell study

(B) ELECTIVE STUDIES

(1) History of bladder dysfunction and dyskinesia; history of overflow diarrhea and fecal impaction
(2) Internal rectal sphincter biopsy
(3) Cystometrogram

(C) DIFFERENTIAL CONSIDERATIONS

In newborns

(1) Colonic atresia
(2) Fecal impaction
(3) Meconium ileus

In older children

(1) Chronic constipation
(2) Mechanical megacolon

(D) PREOPERATIVE TREATMENT AND ORDERS

In newborns

(1) Saline enema and colonic irrigation to rule out fecal impaction.
(2) Parenteral vitamins—C and K.
(3) Wangensteen suction if vomiting

(4) Cut-down and intravenous fluids
(5) Correction of fluid and electrolyte balance as necessary

In older children

(1) Cathartics and enemas to clean bowel out
(2) Sulfasuxidine for 5 days, neomycin for last 24 hours preoperatively (see Appendix)
(3) High protein, high vitamin liquid diet
(4) Intravenous or cut-down *in the arm* night before surgery
(5) Blood chemistry baseline—Cl, CO_2, Na, and K
(6) Catheter in bladder before surgery
(7) Routine preoperative medication (see Chapter 3, p 35)

(E) POSTOPERATIVE MANAGEMENT

In newborns (where only colostomy should be done)

(1) *Orders*
  a) Nothing by mouth for 36-48 hours
  b) Wangensteen suction with 2 cc saline irrigation every 2 hours
  c) Intravenous fluids
  d) Antibiotics
  e) Alimentation when colostomy opened
(2) *Dressings*:
  a) Open colostomy 36 48 hours postoperatively
  b) Change colostomy dressing as necessary
  c) Silicone paste to abdomen as needed
(3) *Study* Blood chemistry determinations every 2 days till well established on oral feedings
(4) *Complications* Rare, except for poor nutritional balance and difficulty in weight gain (persistence with feeding, high caloric intake)

In older children (assuming no colostomy present)

(1) *Orders*
  a) Nothing by mouth till peristalsis returns or flatus expelled
  b) Wangensteen suction with saline irrigation
  c) Intravenous fluids

FIG. 22 —Two types of rectal dilators The finger is the better but a rubber one may have to be used at first.

d) Antibiotics
e) Continuous catheter drainage of urine
f) Alimentary build up as tolerated

(2) *Dressings*
a) Catheter removed fifth to seventh postoperative day
b) Penrose drain removed from pelvis fifth to seventh postoperative day

(3) *Study* Blood chemistry determinations every 2 days till good alimentation established

(4) *Complications*
a) Enteritis (symptomatic treatment, kaopectate and neomycin mixture)
b) Suture line leak (colostomy if not already present, antibiotics)
c) Stenosis at suture line (Wales and finger dilatations)

NEUROBLASTOMA

(A) REQUIRED STUDIES

(1) Physical finding of large abdominal mass
(2) Intravenous pyelogram

(3) Chest film and bone survey
(4) Urinalysis
(5) Bone marrow aspiration

(B) ELECTIVE STUDIES

Gastrointestinal series or barium enema if origin of mass still not clear-cut

(C) DIFFERENTIAL CONSIDERATIONS

(1) Adrenal cortex tumors
(2) Duplication of gastrointestinal tract
(3) Benign ganglioneuroma
(4) Hepatoma
(5) Hydronephrosis
(6) Omental cyst
(7) Pheochromocytoma
(8) Retroperitoneal teratoma
(9) Wilms's tumor

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Hydration by oral intake
(2) Cut-down in vein and adequate hemoglobin replacement if necessary
(3) No palpation of abdomen after initial physical examination Adhesive reminder attached to abdomen (see under "Wilms's Tumor," Chapter 13, p 267)
(4) Antibiotics
(5) Routine preoperative medication (see Chapter 5, p 33)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
a) Nothing by mouth till peristalsis returns (
expelled
b) Wangensteen drainage with irrigation eve
with saline
c) Intravenous fluids

f) Nitrogen mustard course may be considered in first week after surgery

(2) *Studies*

a) Chest film monthly for 3 months, then every 6 months

b) Bone survey every 3 months for 3 years

(3) *Complications* Rare.

OOMPHALOCELE

(A) REQUIRED STUDIES

None.

(B) ELECTIVE STUDIES

(1) Abdominal scout film for ? intestinal obstruction

(2) Search for associated congenital anomalies (40-50% over all incidence 25% malrotation of colon)

(C) DIFFERENTIAL CONSIDERATIONS

None.

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) No mouth feedings—increases size of abdominal contents

(2) Wangensteen suction with 2 cc. saline irrigation every 2 hours

(3) Cut-down

(4) Keep oomphalocele sac moist with saline compresses

(5) Antibiotics

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*

a) Nothing by mouth for 24-48 hours

b) Wangensteen suction and irrigation with 2 cc saline every 2 hours

c) Feedings by tube for 5 7 days to allow for healing before distention allowed to strain closure.

d) Antibiotics

e) Supportive binder if closure is under tension
f) Intravenous fluids—extra blood and plasma supportively.
g) Alimentary build-up as tolerated
h) O_2—isolette preferred

(2) *Complications*
a) Infection (change antibiotics by culture sensitivity)
b) Impaired respiration due to elevated diaphragm (O_2, rectal tube, suction)

OVARIAN CYST

(A) REQUIRED STUDIES

(1) History of intermittent lower abdominal discomfort with episodes of acute pain
(2) Palpation of freely movable, ballottable mass abdominally and/or rectally

(B) ELECTIVE STUDIES

Cystogram or barium enema showing extrinsic pressure on bladder or colon

(C) DIFFERENTIAL CONSIDERATIONS

(1) Duplication of gastro-intestinal tract
(2) Enlarged bladder from posterior urethral valves.
(3) Hydronephrosis
(4) Hydrometrocolpos (hematocolpos)
(5) Neuroblastoma
(6) Omental cyst
(7) Oomphalomesenteric cyst
(8) Sacrococcygeal teratoma
(9) Urachal cyst

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Needle or cut-down for intravenous fluids
(2) Routine preoperative medication (see Chapter 3, p 35)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
a) Nothing by mouth till peristalsis returns or flatus expelled

b) Wangensteen suction with irrigation as indicated (not routine)
c) Alimentary build up as tolerated
d) Intravenous fluids
(2) *Complications* Rare

PATENT OOMPHALOMESENTERIC DUCT REMNANT

(A) REQUIRED STUDIES

(1) History of
a) Draining umbilicus, constant or periodic from birth
b) Tenderness, pain, and redness of umbilicus
(2) Physical finding of
a) Inflamed granulating draining umbilicus
b) Periumbilical intra abdominal mass
(3) Dye studies
a) Ingestion of indigo carmine to see if it appears in umbilical drainage (negative finding does not rule out diagnosis)
b) Intravenous methylene blue to see if it comes from bladder connection (urachus)
(4) Study of drainage to see if fecal elements present (negative finding does not rule out diagnosis)

(B) ELECTIVE STUDY

Injection of sinus tract with radiopaque dye.

(C) DIFFERENTIAL CONSIDERATIONS

(1) Appendiceal abscess
(2) Distended bladder
(3) Omental cyst
(4) Ovarian cyst.
(5) Patent urachus
(6) Urachal cyst

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Eliminate infection as much as possible
a) Soaks

b) Antibiotics
(2) Routine preoperative medication (see Chapter 3, p. 35)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
a) Nothing by mouth till peristalsis returns or flati expelled
b) Wangensteen suction as indicated (not routine)
c) Intravenous fluids
d) Antibiotics
e) Gradual alimentation build-up
(2) *Complication* Wound infection (symptomatic an drainage)

POLYPS OF THE COLON

(A) REQUIRED STUDIES

(1) History of abdominal pain and/or bleeding
(2) X-ray evidence of polyps by air contrast study Th should be done on at least two separate occasions
(3) Proctosigmoidoscopy

(B) ELECTIVE STUDY

Hematologic work-up for blood dyscrasia

(C) DIFFERENTIAL CONSIDERATIONS

(1) Blood dyscrasia
(2) Constipation
(3) Duplication of bowel
(4) Intussusception
(5) Meckel's diverticulum
(6) Scurvy
(7) Ulcerative colitis

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Low residue diet for 5 days, liquid diet for 48 hours before surgery
(2) Cathartic day before surgery

(3) Enemas till clear returns on morning of surgery
(4) Bowel preparation by antibiotics
 a) Sulfasuxidine for 5 7 days before surgery (See Appendix.)
 b) Neomycin for 24 hours before surgery (See Appendix.)
(5) Parenteral vitamin K.
(6) Nothing by mouth for 8 hours before surgery

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
 a) Nothing by mouth till peristalsis returns or flatus expelled
 b) Wangensteen suction as indicated (not routine)
 c) Alimentary build up as tolerated, with low residue diet
 d) Mineral oil nightly for two weeks
 e) Antibiotics.
 f) Intravenous fluids
(2) *Complications* Almost unknown

PORTAL HYPERTENSION

(A) REQUIRED STUDIES

(1) History of
 a) Maternal jaundice during pregnancy
 b) Neonatal peritonitis
 c) Oomphalitis.
 d) Hepatitis
 e) Hematemesis
 f) Melena
 g) Hypersplenism
(2) Physical examination
 a) Hepatomegaly and/or splenomegaly
 b) Collateral circulation (abdominal hemorrhoidal)
(3) Laboratory studies
 a) Liver function studies—total and differential proteins cephalin flocculation bromsulphalein, thymol

turbidity and flocculation, alkaline phosphatase, serum bilirubin, prothrombin time
   b) Complete blood count
(4) X-ray Esophogram to demonstrate varices
(5) Esophagoscopy

(B) ELECTIVE STUDIES

(1) Hepatic vein wedge catheter studies
(2) Hypersplenism studies—bleeding time, clotting time, platelets, clot retraction, reticulocyte count
(3) Nonprotein nitrogen
(4) Percutaneous splenogram

(C) DIFFERENTIAL CONSIDERATIONS

(1) Gastritis
(2) Peptic ulcer
(3) Hypersplenism
(4) Blood dyscrasia

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Red blood count and hemoglobin every 8 hours if actively bleeding
(2) Transfusion as indicated
(3) Nothing by mouth
(4) Intravenous fluids
(5) Blakemore double balloon esophageal tube
(6) O_2 and Trendelenburg position as indicated for shock

(E) POSTOPERATIVE MANAGEMENT

If ligation of esophageal and gastric varices done

(1) *Orders*
   a) Nothing by mouth for 48 hours, then liquid to bland diet, no roughage
   b) Antibiotics and vitamins
   c) Intravenous electrolytes, fluids, and blood
   d) Chest tube (water seal or low suction) drainage for 48 hours

If portocaval or splenorenal shunt done

(1) *Orders* As above

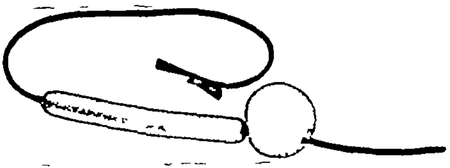

FIG 23—A Blakemore double lumen tube used to control esophageal bleeding. Tube is passed into stomach and lower balloon inflated Tube is pulled up against cardia of stomach and esophageal balloon then inflated.

(2) *Studies*
  a) Portable chest film the morning after surgery
  b) Daily red blood count and hemoglobin
  c) Fat meal with inferior vena cava or renal vein catheterization to assay lipemia proving shunt open
(3) *Complications*
  a) Further bleeding (transfusion)

PYLORIC STENOSIS

(A) REQUIRED STUDIES

(1) History of vomiting of increasing frequency and severity
(2) Physical examination while sucking sugar nipple or glucose water
  a) Palpable mass
  b) Peristaltic waves
  c) Vomitus free of bile
  } makes the diagnosis
(3) Blood chemistry determinations CO_2, Cl Na, and K
(4) Hydration estimation by amount and specific gravity of urine

(B) ELECTIVE STUDIES

(1) Esophogram and upper gastrointestinal series if no mass palpable
(2) Subdural taps where indicated

(C) DIFFERENTIAL CONSIDERATIONS

(1) Central nervous system disease
(2) Chalasia
(3) Congenital esophageal stenosis
(4) Duodenal bands.
(5) Malrotation of colon
(6) Poor feeding habits—formula, speed, burping
(7) Pylorospasm
(8) Vascular ring

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Correction of electrolytic balance as necessary
(2) Parenteral vitamins—B, C, and K
(3) Nothing by mouth
(4) Intravenous fluids

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
  a) Nothing by mouth for 4-6 hours
  b) Modified Down's feedings started 4-6 hours post operatively (see Appendix)
  c) Keep baby on right side or on abdomen
  d) Stop intravenous fluids 24 hours after surgery
(2) *Dressings* Nothing unusual
(3) *Study* Blood chemistries only if vomiting
(4) *Complications*
  a) Uncommon, and treated symptomatically
  b) Antispasmodics used rarely but when indicated
  c) Perforation of duodenum (reoperate and close whole pyloromyotomy at serosal surface Rotate pylorus and do fresh pyloromyotomy)

RUPTURED ABDOMINAL VISCUS

(Bowel, Kidney, Spleen, Liver)

(A) REQUIRED STUDIES

(1) History of
  a) Trauma

b) Pain in abdomen
c) Dyspnea
(2) Physical examination
a) Borderline shock.
b) Peritoneal irritation—tenderness spasm, rebound hypoperistalsis
c) Hematuria.
d) External evidence of trauma
(3) Laboratory examination
a) Complete blood count
b) Urinalysis
c) Stool for blood
(4) X rays
a) IV pyelogram
b) Supine and erect abdominal

(B) ELECTIVE STUDIES

(1) Cystoscopy
(2) Paracentesis for blood

(C) DIFFERENTIAL CONSIDERATIONS

(1) Ruptured bowel with pneumoperitoneum
(2) Ruptured kidney
(3) Ruptured spleen.
(4) Ruptured liver

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Intravenous or cut-down for blood and fluid replacement
(2) Shock measures
a) Trendelenburg position
b) Heat.
c) Morphine
(3) Blood pressure and blood count checks frequently
(4) Antibiotics
(5) Nothing by mouth
(6) Preoperative medication in consultation with anesthetists

(E) POSTOPERATIVE MANAGEMENT
(Assuming splenectomy, nephrectomy, liver or bowel suture)

(1) *Orders.*
a) Nothing by mouth till peristalsis returns or flatus expelled
b) Continuous Wangensteen drainage with irrigation
c) Intravenous fluids
d) Antibiotics
e) O_2
f) Alimentation build-up as tolerated

(2) *Dressings.* Stab wound drains out on third to fifth day

(3) *Studies*
a) Blood counts daily to be sure of no further bleeding or hyperthrombocytemia
b) Blood chemistries as indicated by prolonged Wangensteen drainage

(4) *Complication* Secondary hemorrhage (transfuse and/or re-explore)

SACRO-COCCYGEAL TERATOMA

(A) REQUIRED STUDIES

(1) Physical examination
a) Showing buttocks and/or pelvic mass attached to sacrum
b) Showing no neurologic deficit

(2) Anteroposterior and lateral x-rays of lumbosacral area

(B) ELECTIVE STUDY

Intravenous pyelogram

(C) DIFFERENTIAL CONSIDERATIONS

(1) Buttocks abscess
(2) Chordoma
(3) Duplication of rectum
(4) Myelomeningocele

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Antibiotics
(2) Cut-down

FIG. 24—Collodion type of dressing used in sacrococcygeal surgery to keep wound clean and tight during healing. Baby is kept on its stomach

(3) Rectal tube inserted
(4) Routine preoperative medication (see Chapter 3 p 35)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
  a) Fluids postnausea.
  b) Keep on abdomen till stitches are out.
  c) Foam rubber knee and elbow pads
  d) Antibiotics
(2) *Dressings*
  a) Drain in dead space removed from stab wound on fourth to sixth postoperative day
  b) Reinforce collodion as needed
(3) *Study* Careful sectioning of teratoma to rule out malignancy

(4) *Complication* · Infection (symptomatic treatment, drainage)

ULCERATIVE COLITIS

(A) REQUIRED STUDIES

(1) History of chronic frequency of stools with cramps, mucus, pus, and blood
(2) Physical appearance of cachexia and emaciation
(3) Proctoscopy
(4) Barium enema showing characteristic changes
(5) Stool culture
(6) Stool examination for amebae

(B) ELECTIVE STUDIES

(1) Serum febrile agglutinins
(2) Chest film
(3) Old tuberculin skin test 1 1000 and 1 100

(C) DIFFERENTIAL CONSIDERATIONS

(1) Amebic dysentery
(2) Beriberi
(3) Gastroenteritis
(4) Mucous colitis
(5) Pellagra
(6) Sprue
(7) Tuberculosis

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) A course of conservative management with
  a) Dietary regimen—bland, low-residue foods
  b) Antispasmodics
  c) Cortisone
  d) Intensive psychotherapy
(2) Failure of (1) is indication for ileostomy with·
  a) Bowel preparation with sulfasuxidine® for 5 days and neomycin for 24 hours preoperatively (see Appendix)
  b) Liquid diet for 48-72 hours preoperatively
  c) Blood replacement as indicated.

d) Baseline blood chemistry determinations
e) Routine preoperative medication (see Chapter 3 p 35)

(3) Failure of a reanastomosis of ileum and colon with recrudescence of disease means colectomy with same bowel preparation as under (2)

(E) POSTOPERATIVE MANAGEMENT

In ileostomized patient

(1) *Orders*
a) Nothing by mouth till ileostomy clamp off and peristalsis has returned
b) Intravenous fluids
c) Alimentary build up as tolerated with bland low residue foods
d) Antibiotics
e) Paregoric and kaopectate every 3 or 4 hours after ileostomy open (see Appendix)

(2) *Dressings*
a) Remove ileostomy clamp 36-48 hours postoperatively
b) Silicone paste to abdominal wall liberally
c) Fit ileostomy bag as early as practicable.

(3) *Study* Daily blood chemistries because of ileostomy losses

(4) *Complication* Severe excoriation of abdominal wall (patient on abdomen, on Bradford frame)

In colectomized patient

(1) *Orders*
a) Nothing by mouth till peristalsis returns or flatus expelled
b) Wangensteen suction with 2 cc saline irrigation every 2 hours
c) Intravenous fluids
d) Alimentary build up as tolerated with bland, low residue foods
e) Antibiotics.
f) Paregoric and kaopectate every 3-4 hours if watery stooling (see Appendix)

(4) *Complication* · Infection (symptomatic treatment, drainage)

ULCERATIVE COLITIS

(A) REQUIRED STUDIES

(1) History of chronic frequency of stools with cramps, mucus, pus, and blood
(2) Physical appearance of cachexia and emaciation
(3) Proctoscopy
(4) Barium enema showing characteristic changes
(5) Stool culture
(6) Stool examination for amebae

(B) ELECTIVE STUDIES

(1) Serum febrile agglutinins
(2) Chest film
(3) Old tuberculin skin test 1 1000 and 1 100

(C) DIFFERENTIAL CONSIDERATIONS

(1) Amebic dysentery
(2) Beriberi
(3) Gastroenteritis
(4) Mucous colitis
(5) Pellagra
(6) Sprue
(7) Tuberculosis

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) A course of conservative management with
 a) Dietary regimen—bland, low-residue foods
 b) Antispasmodics
 c) Cortisone
 d) Intensive psychotherapy
(2) Failure of (1) is indication for ileostomy with
 a) Bowel preparation with sulfasuxidine® for 5 days and neomycin for 24 hours preoperatively (see Appendix)
 b) Liquid diet for 48-72 hours preoperatively
 c) Blood replacement as indicated.

d) Baseline blood chemistry determinations
e) Routine preoperative medication (see Chapter 3 p 35)

(3) Failure of a reanastomosis of ileum and colon with recrudescence of disease means colectomy with same bowel preparation as under (2)

(E) POSTOPERATIVE MANAGEMENT

In ileostomized patient

(1) *Orders*
a) Nothing by mouth till ileostomy clamp off and peristalsis has returned
b) Intravenous fluids.
c) Alimentary build up as tolerated with bland low residue foods
d) Antibiotics
e) Paregoric and kaopectate every 3 or 4 hours after ileostomy open (see Appendix)

(2) *Dressings*
a) Remove ileostomy clamp 36-48 hours postoperatively
b) Silicone paste to abdominal wall liberally
c) Fit ileostomy bag as early as practicable

(3) *Study* Daily blood chemistries because of ileostomy losses.

(4) *Complication* Severe excoriation of abdominal wall (patient on abdomen on Bradford frame)

In colectomized patient

(1) *Orders*
a) Nothing by mouth till peristalsis returns or flatus expelled
b) Wangensteen suction with 2 cc. saline irrigation every 2 hours
c) Intravenous fluids
d) Alimentary build up as tolerated with bland, low residue foods
e) Antibiotics
f) Paregoric and kaopectate every 3-4 hours if watery stooling (see Appendix)

(2) *Study* Blood chemistry determinations if watery stools
(3) *Complications* Not common postoperatively—long term problems disheartening

VOLVULUS

(A) REQUIRED STUDIES

(1) History of intestinal obstruction triad—vomiting, scanty stools, and distention
(2) Physical findings of vague abdominal mass and/or melena (these not absolutely constant)
(3) X-rays of intestinal obstruction—closed or open loop types
(4) Blood chemistry determinations

(B) ELECTIVE STUDIES

None—a barium enema for associated malrotation of colon is traumatic and depleting

(C) DIFFERENTIAL CONSIDERATIONS
(Academic, since intestinal obstruction requires laparotomy)

(1) Annular pancreas.
(2) Central nervous system disease
(3) Chalasia
(4) Duodenal bands
(5) Malrotation of colon
(6) Meconium ileus
(7) Poor feeding habits
(8) Pyloric stenosis

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Electrolyte and fluid correction as indicated
(2) Cut-down in vein
(3) Antibiotics
(4) Parenteral vitamins—C and K
(5) Wangensteen suction with 2 cc irrigations of saline every 2 hours

(E) POSTOPERATIVE MANAGEMENT

See Intestinal Atresia "Orders," p 112
(1) *Complications* Unusual unless resection of gangrenous

bowel leaves insufficient amount of small intestine (diet with antispasmodics to slow transit time)

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CHAPTER 9

Thoracic

EDWARD M KENT,
WILLIAM B KIESEWETTER
and S RICHARD BAUERSFELD

ABSCESS OF LUNG

REQUIRED STUDIES

1 History of antecedent acute pulmonary infection, surgery with or without general anesthesia, especially about the oropharynx, episode of unconsciousness due to any cause, permitting aspiration of pharyngeal secretions, foreign body Cough, fever, expectoration of purulent secretions, sometimes of characteristic putrid odor
2 Chest films (serial studies) multiple projections
3 Bronchoscopy
4 Sputum culture and antibiotic sensitivity testing of organisms grown
5 Tuberculin testing
6 Intensive use of antibiotic therapy, including aerosol inhalation methods

ELECTIVE STUDIES

None

DIFFERENTIAL CONSIDERATIONS

1 Infected pulmonary cyst (incl "incarcerated lung" type)

2 Adult type pulmonary tuberculosis with cavitation
3 Loculated empyema with bronchopleural fistula

PREOPERATIVE MANAGEMENT AND ORDERS

The combined use of antibiotic therapy and bronchoscopy is so effective in the treatment of lung abscess in children that additional surgical measures are rarely required When these infrequent occasions are encountered

1 Antibiotic therapy to be continued including aerosol inhalation measures

OPERATIVE OBJECTIVES AND METHODS

When conservative measures of therapy fail, excision of the involved pulmonary unit is required This may mean segmental resection, lobectomy or rarely total pneumonectomy

POSTOPERATIVE MANAGEMENT

1 Employ precautions to assure that blood replacement has been adequate
2 Continue use of antibiotic therapy
3 Oxygen therapy
4 Maintenance of clear airway
5 Achieve re-expansion of remaining pulmonary units and evacuation of pleural fluid (intercostal tube drainage closed type)
6 Early ambulation.
7 Early alimentation

COMPLICATIONS

1 *Bronchopleural fistula (closed tube, intercostal suction with* varidase® surgical closure and decortication)
2 Empyema (same as 1)
3 Secondary hemorrhage (rare)
4 Wound infection (rare)
5 Brain abscess and/or meningitis (rare)
6 Failure to achieve complete re-expansion of remaining lung (closed tube, intercostal suction)

COMPLICATIONS

1 Thrombosis at site of anastomosis (no treatment)
2 Heart failure (medical management, digitalis, low salt, etc)

AORTIC STENOSIS, CONGENITAL OR ACQUIRED

Acquired rheumatic aortic valvular disease is extremely rare in children so that, when encountered, the etiology is usually congenital or secondary to endocardial fibro-elastosis To date no significant experience has been obtained with the surgical treatment of this lesion in children The present philosophy is that more attempts should be made to open the valve by modifications of technics now used for adults The diagnostic methods will be the same as in adults Pre and postoperative management will be essentially the same as in any other cardiac surgery

BRANCHIAL CLEFT REMNANTS

(A) REQUIRED STUDY

Physical examination generally makes the presumptive diagnosis

(B) ELECTIVE STUDIES

(1) X-rays of chest and neck for extension of process
(2) Direct laryngoscopy for internal opening to remnant
(3) Radioactive iodine uptake studies if mass suspected of being "aberrant thyroid"

(C) DIFFERENTIAL CONSIDERATIONS

(1) "Aberrant thyroid nodule"—carcinoma
(2) Dermoid cyst
(3) Fibroma of sternocleidomastoid muscle
(4) Lymphangioma (cystic hygroma)
(5) Lymphadenopathy
(6) Thyroglossal cyst

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Be sure inflammatory process has subsided if infected
(2) Routine preoperative medications by age and weight (see Chapter 3, p 35)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
  a) Postoperative feedings postnausea
  b) Ambulatory
  c) Home 24-48 hours postoperatively

(2) *Complications* Rare.

BRONCHIECTASIS

REQUIRED STUDIES

1 History of chronic productive cough hemoptysis recurrent acute pulmonary infections, retarded physical development clubbing of fingers and toes
2 Chest films
3 Bronchogram for proof of diagnosis and localization of disease.
4 Bronchoscopy
5 Sputum culture and examination for acid fast bacilli
6 Intradermal tuberculin test

ELECTIVE STUDIES

None

DIFFERENTIAL CONSIDERATIONS

1 Pulmonary tuberculosis
2 Pulmonary abscess
3 Congenital cystic disease of lung

PREOPERATIVE MANAGEMENT AND ORDERS

1 Postural drainage
2 Antibiotic therapy oral and parenteral based on culture of organisms from sputum and antibiotic sensitivity tests
3 Inhalation aerosol therapy containing appropriate antibiotic (chosen as above) and wetting agents or detergents
4 Restore circulating blood volume to normal
5 Correction of malnutrition if present
6 Careful postural drainage immediately prior to surgery
7 Bronchoscopy on operating table after induction of anesthesia if excessive secretions are evident

8 Cancellation of operation if secretions cannot be satisfactorily aspirated by bronchoscopy

OPERATIVE OBJECTIVES AND METHODS

Resection of diseased segments of lungs as proved by bronchography. Segmental resection, lobectomy, and total pneumonectomy are required according to circumstances Bilateral disease is not a contraindication to surgery if total ablation of the disease can be accomplished, leaving approximately the equivalent of two upper lobes (excluding inferior division of left upper lobe) of functioning normal pulmonary tissue Bilateral excisional surgery is more safely planned in stages, generally attacking first the side which has the greatest amount of demonstrable disease or infection

POSTOPERATIVE MANAGEMENT

1 Be certain blood replacement during surgery has been adequate
2 Continued use of antibiotic therapy
3 Oxygen therapy usually advantageous, sometimes a necessity
4 Clear airway must be assured This means careful nursing with attention to "coughing the patient," an intratracheal aspiration by catheter, bronchoscopy and, when necessary, tracheostomy
5 Re-expansion of remaining segments of lobe of lung on operated side. The intercostal tubes inserted at time of surgery will make this possible when connected to water seal trap Gentle mechanical suction applied to the water seal bottle will enhance the achievement of this objective If tubes become obstructed, or fail to evacuate the air and fluid, thoracentesis will be needed Tubes are removed when these objectives have been attained
6 Early ambulation
7 Early alimentation

COMPLICATIONS

1 Bronchopleural fistula (closed tube, intercostal suction with varidase[1], surgical closure and decortication)
2 Empyema (same as 1)

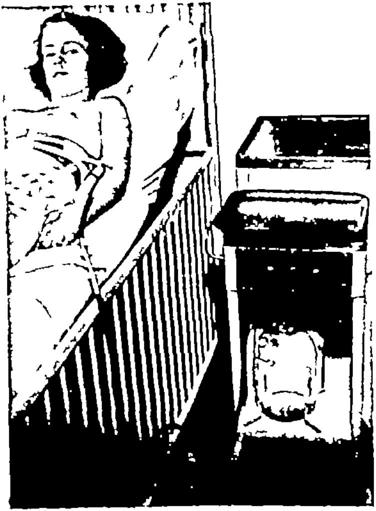

Fig. 25.—Chest drainage as employed where constant suction is necessary showing drainage pump, which delivers 90-120 mm. suction, with underwater seal and trap between pump and patient.

3 Secondary hemorrhage (rare)
4 Wound infection (rare)
5 Pneumonitis (change antibiotics, O_2)
6 Failure to achieve complete re-expansion of remaining lung (closed tube, intercostal suction)

COARCTATION OF AORTA

REQUIRED STUDIES

Physical examination will usually disclose hypertension in upper extremities and hypotension in lower extremities Diagnosis must be entertained in all infants presenting heart failure Symptoms usually absent but may include headaches, cerebrovascular accident, and (in infants) heart failure

1 Palpation of abdominal aorta and femoral arteries
2 Blood pressure determinations in all extremities
3 X-ray and fluoroscopic studies of chest (heart size, rib notching, absent or small aortic knob)
4 Electrocardiogram (usually normal)

ELECTIVE STUDIES

1 Aortography, in infants and in any child if aortic grafts or prosthesis not available for immediate use at operation
2 Rarely, cardiac catheterization to exclude associated defects

DIFFERENTIAL CONSIDERATIONS

1 Congenital aortic stenosis
2 Preductile or postductile position

PREOPERATIVE MANAGEMENT

Treat heart failure when present

OPERATIVE OBJECTIVES AND METHODS

1 Resection of coarctation (postductile) with end-to end anastomosis
2 Use of aortic graft only when length of resected coarctation or presence of an aneurysm makes it necessary
3 In preductile coarctation one may employ resection or bypass with either graft or left subclavian artery

POSTOPERATIVE MANAGEMENT

1. Assurance of adequate blood replacement.
2. Antibiotic therapy
3. Oxygen therapy
4. Achieve full expansion of lung and evacuation of pleural fluid by chest tube, closed drainage
5. Continue cardiac management and observe carefully for onset of heart failure

COMPLICATIONS

1. Leak of anastomosis (rare)
2. Heart failure (medical management—digitalis low salt, etc.)
3. Failure to achieve full expansion of lung and evacuation of pleural fluid (thoracentesis or intercostal suction drainage)
4. Infection at suture line (blood culture and change of antibiotics accordingly)

CONGENITAL LUNG CYSTS

REQUIRED STUDIES

1. History of
   (a) Exertional dyspnea
   (b) Repeated pulmonary infections
   (c) Occasionally asymptomatic.
2. Chest x ray
3. Bronchoscopy and occasionally bronchograms

DIFFERENTIAL CONSIDERATIONS

1. Emphysematous blebs or bullae
2. Postpneumonic bullae
3. Hamartoma.

INDICATIONS FOR SURGERY

1. Space occupying lesion causing symptoms
2. Infected cyst.

PREOPERATIVE MANAGEMENT

Treat infection if present.

OPERATIVE OBJECTIVES AND METHODS

Resection of involved area

POSTOPERATIVE MANAGEMENT

1 Antibiotics
2 Water seal drainage until lung expanded as demonstrated by x-ray, and tube no longer draining
3 Oxygen therapy for as long as necessary
4 Endotracheal and/or bronchoscopic removal of secretions to maintain patent airway Occasionally tracheotomy necessary
5 Fluids and diet as indicated for age, postnausea Parenteral fluids usually necessary for first 24 hours

COMPLICATIONS

1 Bronchopleural fistula (closed tube, intercostal suction with varidase®, surgical closure and decortication)
2 Empyema (same as 1)
3 Secondary hemorrhage (rare)
4 Wound infection (rare)
5 Pneumonitis (change antibiotics, O_2)
6 Failure to achieve complete re-expansion of remaining lung (closed tube, intercostal suction)

DIAPHRAGMATIC HERNIA

REQUIRED STUDIES

1 History of
   (a) Cyanosis
   (b) Dyspnea
   (c) Nausea and vomiting
2 Physical examination
   (a) Respiratory lag on one side to observation
   (b) Absent breath sounds unilaterally
   (c) Apex beat of heart greatly shifted
   (d) Peristalsis heard in chest
3 X-ray
   (a) Single chest film generally shows diagnostic gas loops in chest

FIG. 26—A simple method of tube feeding used in diaphragmatic hernia cases postoperatively Tube feeding reduces distention and consequent strain on hernia repair

(b) Gastrointestinal series occasionally necessary to see barium in chest

ELECTIVE STUDY

Blood chemistry determinations—CO_2, Cl, Na, and K.

DIFFERENTIAL CONSIDERATIONS

1 Esophageal atresia with or without tracheo-esophageal fistula.
2. Tracheo-esophageal fistula without esophageal atresia.
3 Vascular ring
4 Pneumatocele
5 Congenital lung cysts
6 Empyema with staphylococcus or Friedlander s organism
7 Be alert for malrotation of gut (1 in 6 have it)

PREOPERATIVE TREATMENT AND ORDERS

1 This is surgical emergency in neonatal child and correction should be done as soon as diagnosis is made
2 Correction of electrolytes when necessary
3 Nothing by mouth
4 Cut-down in right leg
5 Penicillin and streptomycin by weight
6 Parenteral vitamins

POSTOPERATIVE MANAGEMENT

1 *Orders*
 (a) Intercostal chest drainage for 48-72 hours
 (b) Levine tube in stomach with continuous suction to keep gastrointestinal tract decompressed and no tension on repaired diaphragm This last 48-72 hours
 (c) First 48-72 hours of oral feedings are through Levine tube to lessen swallowing of air
 (d) Child on right side for 1 hour after feedings
 (e) Antibiotics
 (f) Parenteral fluids till on established alimentary feedings
2 *Study* Portable chest the morning after surgery

COMPLICATIONS

Rare

OBSTRUCTIVE EMPHYSEMA

REQUIRED STUDIES

1 Often asymptomatic but may be associated with dyspnea and, more rarely, cyanosis
2 X-ray studies of chest, inspiration-expiration films
3 Bronchoscopy
4 Bronchography

ELECTIVE STUDIES

None

DIFFERENTIAL CONSIDERATIONS

1 Congenital cystic disease of lung
2 Foreign body in bronchus.

3. So-called incarcerated lung, variant of congenital cystic disease of lung
4. Pulmonary abscess
5. Pulmonary blebs or bullae

PREOPERATIVE MANAGEMENT AND ORDERS

1. Antibiotic therapy usually penicillin alone unless contraindicated
2. Assurance that circulating blood volume is within normal limits
3. Correction of malnutrition if present
4. Bronchoscopy

OPERATIVE OBJECTIVES AND METHODS

Surgery is rarely required When necessary resection of involved pulmonary unit is performed

POSTOPERATIVE MANAGEMENT

1. Use of precautions to assure that adequate blood replacement has been effected
2. Continued use of antibiotic therapy
3. Oxygen therapy
4. Maintenance of clear airway
5. Achieve re-expansion of remaining lung tissue and evacuation of pleural effusion
6. Early ambulation
7. Early alimentation

COMPLICATIONS

1. Bronchopleural fistula (closed tube, intercostal suction with varidase® surgical closure and decortication)
2. Empyema (same as 1)
3. Secondary hemorrhage (rare)
4. Wound infection (rare)

EMPYEMA AND HEMOTHORAX

REQUIRED STUDIES OPERATIVE OBJECTIVES AND MANAGEMENT

1. Chest x rays—serial films to diagnose and follow results of therapy

2. Culture of empyema for organisms with sensitivity tests so that proper antibiotic therapy can be given
3. Acute empyema is usually secondary to pneumonia or lung abscess Can frequently be managed by aspiration, antibiotics systemically and locally, and enzymes as long as fluid pus is present When pus becomes thickened, closed drainage is established initially and maintained if situation is improving Otherwise open drainage is established
4. Chronic empyema is usually due to undiagnosed or mismanaged acute disease Treatment is by open drainage with rib resection If unsuccessful or evidence of frozen rib cage decortication is indicated to regain pulmonary function
5. Hemothorax is primarily due to trauma Blood in the pleural cavity does not necessarily resorb and frequently clots early, contrary to previous teaching For that reason all acute hemothoraces should be aspirated to prevent development of fibrothorax If latter develops it will be necessary to do a pulmonary decortication to free lung and rib cage

COMPLICATIONS

Bronchopleural fistula, primary or secondary (requires drainage closed or open)

POSTOPERATIVE MANAGEMENT FOR DECORTICATION

1. Antibiotics
2. Water seal drainage until lung expanded as demonstrated by x-ray
3. Oxygen therapy for as long as necessary
4. Endotracheal and/or bronchoscopic removal of secretions to maintain patent airway Occasionally tracheotomy necessary
5. Fluids and diet as indicated for age, postnausea Parenteral fluids usually necessary for first 24 hours
6. These patients will usually require two or more chest tubes for drainage postoperatively because of parenchymal air leaks Preferably an anterior tube in the second interspace and an anterolateral one low are employed Suction to water-seal bottles is usually necessary

ESOPHAGEAL ATRESIA WITH OR WITHOUT TRACHEO-ESOPHAGEAL FISTULA

REQUIRED STUDIES

1. History of excessive mucus and/or repeated cyanosis
2. Insertion of No. 8 French catheter under fluoroscopy meeting obstruction 9-11 cm. from tip of nose
3. Anteroposterior and lateral chest and abdominal films to reveal curling of catheter in atretic esophagus, atelectasis, presence or absence of gas in gastrointestinal tract through fistula, possible gastrointestinal obstruction also
4. Hydration estimation

ELECTIVE STUDY

Contrast media in upper esophagus not necessary or desirable

DIFFERENTIAL CONSIDERATIONS

No outstanding ones

PREOPERATIVE TREATMENT AND ORDERS

1. Parenteral vitamins—C and K
2. Antibiotics
3. Nothing by mouth
4. Frequent suctioning to keep airway clear
5. Cut-down for intravenous fluids
6. Oxygen and warmth—incubator or isolette preferable

POSTOPERATIVE MANAGEMENT

Orders

1. Nothing by mouth for 48 hours then gradually build up by mouth, by polyethylene tube placed through anastomosis into stomach at operation, or by gastrostomy
2. High humidity atmosphere
3. Head of bed elevated 20-30°
4. Suctioning of oropharynx when *but only when* necessary
5. Intravenous fluids—keep on low side (20-30 cc./lb.) for 48 hours
6. Antibiotics

ESOPHAGEAL ATRESIA WITH OR WITHOUT TRACHEO-ESOPHAGEAL FISTULA

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POSTOPERATIVE MANAGEMENT

Orders

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2 High humidity atmosphere
3 Head of bed elevated 20-30°
4 Suctioning of oropharynx when, *but only when* necessary
5 Intravenous fluids—keep on low side (20 30 cc./lb) for 48 hours
6 Antibiotics

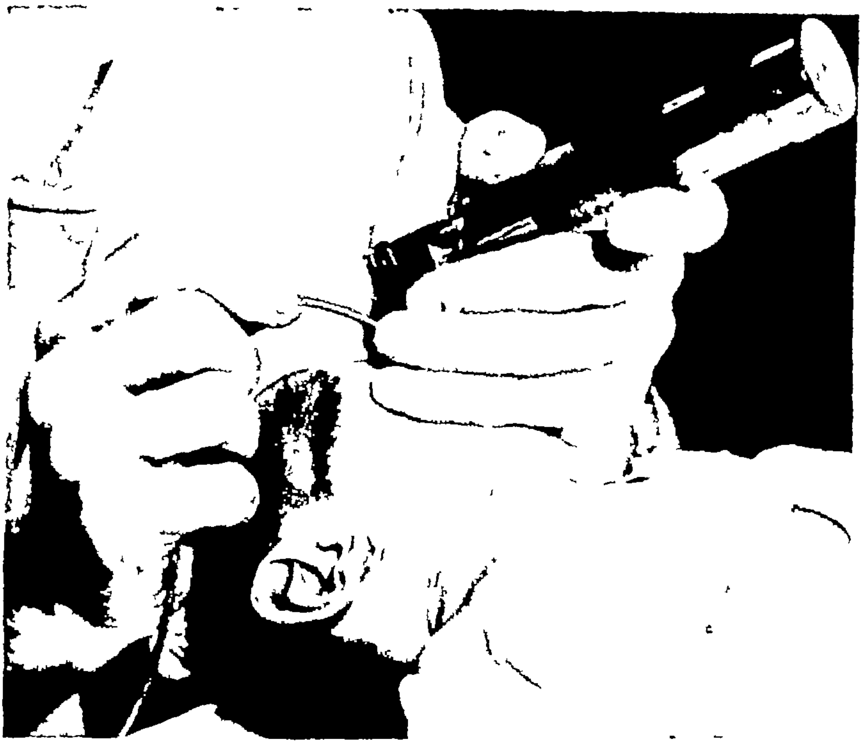

FIG 27 —A tracheo-esophageal fistula patient undergoing endotracheal aspiration on first postoperative day

7 Salt and potassium—by age, size, and urination
8 Direct laryngoscopic endotracheal aspiration first postoperative day

Dressings

1 Chest tube removed when well started on alimentary feedings
2 Stitches—sixth to eighth postoperative day

Study Esophogram before discharge is elective

Complications

1 Leaking anastomosis (reoperate to bring upper pouch into neck, close lower esophagus and perform gastrostomy)
2 Stenosis—clinical symptoms, not x-ray, are diagnostic (not common, but dilatation necessary).
3 Recurrence of fist[illegible] connectio[illegible] needs surgical correction[illegible]
4 Cut down ph[illegible] most

ESOPHAGEAL STENOSIS

(NOT POSTOPERATIVE)

REQUIRED STUDIES

1 History of
   (a) Dysphagia
   (b) Regurgitation
   (c) Ingestion of cicatrix forming substance
   (d) Poor weight gain
2 X ray Fluoroscopy and barium swallow
3 Esophagoscopy

ELECTIVE STUDIES

Blood chemistry determinations

DIFFERENTIAL CONSIDERATIONS

1 Vascular ring
2 Mediastinal tumefaction
3 Duplication of esophagus
4 Pyloric stenosis (in neonatal)
5 Achalasia.
6 Chalasia.

PREOPERATIVE TREATMENT AND ORDERS

1 Electrolyte correction where necessary
2 Liquid diet only
3 If conservative dilatations from above are to be used Nothing special in management.
4 If gastrostomy and retrograde dilatations to be employed
   (a) Antibiotics given preoperatively
   (b) Intravenous fluids (needle or cut-down)
   (c) Parenteral vitamins
5 If transthoracic resection and anastomosis to be used
   (a) Antibiotics.
   (b) Cut-down and parenteral fluids
   (c) Parenteral vitamins

POSTOPERATIVE MANAGEMENT

Orders

When gastrostomy

1 Nothing through tube for 48 hours
2 Water to formula or high protein liquid build-up in intake
3 Keep on right side after feedings
4 Antibiotics

When resection

1 Nothing by mouth for 72 hours
2 Intercostal catheter drainage till mouth feeding well established
3 Antibiotics

Dressings Nothing unusual

Study Chest films morning after transthoracic procedure and as indicated thereafter

Complications

1 Not common, but perforation by dilatation from above can occur (nothing by mouth, mediastinal drainage)
2 Esophageal anastomosis can leak in early postoperative period (cervical esophagostomy and gastrostomy)

ESOPHAGEAL VARICES

See Portal Hypertension (Abdominal), p 113

INTERATRIAL SEPTAL DEFECT

REQUIRED STUDIES

This is one of the acyanotic congenital heart defects with an increased pulmonary blood flow which usually causes difficulty either in early infancy or later life Pulmonary hypertension may develop with eventual reversal of the shunt as the right side of the heart fails

1 X-ray and fluoroscopy
   (a) Increased pulmonary blood flow
   (b) Enlarged right ventricle
   (c) Enlarged right auricle
   (d) Enlarged pulmonary artery
2 Electrocardiogram
   (a) Right ventricular hypertrophy
   (b) Complete or partial right bundle branch block

ELECTIVE STUDIES

1 Cardiac catheterization
2 Selective angiocardiography occasionally

DIFFERENTIAL CONSIDERATIONS

1 Anomalous pulmonary venous return
2 Interventricular septal defect
3 Pulmonic stenosis

PREOPERATIVE MANAGEMENT

Treat heart failure, if present

OPERATIVE OBJECTIVE AND METHODS

Closure of defect by
1 Closed technics
   (a) Atrio-septopexy
   (b) Gross well with direct suture or use of prosthetic graft
   (c) Purse string suture (Sundergaard technic)
2 Direct vision repair—using hypothermia or artificial heart lung

There are two basic lesions pathologically
1 Ostium secundum in which there is always tissue available for repair Closed technics are probably satisfactory
2 Ostium primum in which the defect is immediately above the auriculoventricular valves, which are usually deformed with functional mitral insufficiency Repair is much more difficult and dangerous Probably best done under direct vision

POSTOPERATIVE MANAGEMENT

1 Assurance of adequate blood replacement
2 Antibiotic therapy
3 Oxygen therapy
4 Achieve full expansion of lung and evacuation of pleural fluid by chest tube closed drainage.
5 Continue cardiac management and observe carefully for onset of heart failure

COMPLICATIONS

Heart failure (rare)

INTERVENTRICULAR SEPTAL DEFECT

REQUIRED STUDIES

One of the acyanotic congenital heart lesions with increased pulmonary blood flow The lesion is characteristically located in the membranous portion of the ventricular septum When the defect is in the muscular portion, the shunt is seldom large enough to cause difficulty Heart failure in infants is commonly due to this lesion

1 X-ray and fluoroscopy
   (a) Increased pulmonary vascular markings
   (b) Enlarged right ventricle
2 Electrocardiogram (right ventricular hypertrophy)

ELECTIVE STUDIES

Cardiac catheterization

DIFFERENTIAL CONSIDERATIONS

1 Patent ductus
2 Interatrial septal defect

PREOPERATIVE MANAGEMENT

Treat heart failure if present

OPERATIVE OBJECTIVE AND METHODS

Closure of defect by
1 Closed technics—unsatisfactory
2 Direct vision suturing possible with aid of artificial heart-lung Risk is high since only patients with heart failure and pulmonary hypertension are being operated on at present This will probably decrease as better risks are offered surgery

POSTOPERATIVE MANAGEMENT

1 Assurance of adequate blood replacement
2 Antibiotic therapy
3 Oxygen therapy
4 Achieve full expansion of lung and evacuation of pleural fluid by chest tube closed drainage

5 Continue cardiac management and observe carefully for on set of heart failure

COMPLICATIONS

1 Heart failure (medical management—digitalis low salt, etc.)
2 Bronchopneumonia (O_2, antibiotics, digitalis)

LUNG TUMORS

REQUIRED STUDIES

Lung tumors in children and infants are rare When present, the diagnosis is usually established because of studies resulting from symptoms due to bronchial obstruction

1 Chest x rays
2 Metastatic lesions from kidney tumors are common so that any pulmonary lesion in children should have renal studies, e.g., intravenous pyelogram, urinalysis
3 Bronchoscopy

ELECTIVE STUDIES

1 Sputum cytology
2 Angiocardiography to prove presence or absence of pul monary arterio-venous fistula.

DIFFERENTIAL CONSIDERATIONS

1 Hamartoma.
2 Bronchial adenoma.
3 Arterio-venous fistula.

PREOPERATIVE MANAGEMENT

Treat pulmonary complications e g bronchiectasis pneumonia, etc.

OPERATIVE OBJECTIVES AND METHODS

Resection of lesion locally or with lung resection as indicated Hamartomas may frequently be wedged out or enucleated Ade nomas are generally considered a low grade malignancy con servative resection is indicated if a good margin of tissue can be

obtained (and confirmed by frozen section) Frequently infection distal to the tumor has so destroyed the lung that at least lobectomy is indicated

POSTOPERATIVE MANAGEMENT

1 Antibiotics
2 Water seal drainage until lung expanded as demonstrated by x-ray and tube no longer draining
3 Oxygen therapy for as long as necessary
4 Endotracheal and/or bronchoscopic removal of secretions to maintain patent airway Occasionally tracheotomy necessary
5 Fluids and diet as indicated for age, postnausea Parenteral fluids usually necessary for first 24 hours

COMPLICATIONS

1 Bronchopleural fistula (closed tube, intercostal suction with varidase®, surgical closure and decortication)
2 Empyema (same as 1)
3 Secondary hemorrhage (rare)
4 Wound infection (rare)
5 Pneumonitis (change antibiotics, O_2)
6 Failure to achieve complete re-expansion of remaining lung (closed tube, intercostal suction)

MEDIASTINAL TUMORS

REQUIRED STUDIES

1 History variable, may have any of the following.
Respiratory embarrassment, frequent respiratory infections, secondary to partial bronchial obstruction, pain secondary to invasion, vena caval obstruction, dysphagia secondary to compression of esophagus, occasionally asymptomatic
2 Chest x-ray, supplemented by contrast medium studies as indicated by symptoms and location of lesion
3 Hematologic workup
4 Tuberculin skin test
5 Bone marrow aspiration

ELECTIVE STUDY

Aspiration biopsy

FIG 78 —A typical chest dressing, showing intercostal stab wound suction with tube well taped The suture line is dressed with expansile elastoplast with no constricting adhesive to obstruct full inspirational effort.

DIFFERENTIAL CONSIDERATIONS

The differential diagnosis of mediastinal tumors is based on location within the mediastinum

1 Anterior mediastinum
   (a) Teratoma
   (b) Thymoma.
   (c) Lymphoma.
   (d) Bronchogenic cyst.
   (e) Pericardial cyst.
   (f) Foramen of Morgagni s hernia.
   (g) Aberrant thyroid
   (h) Lymphangioma.
2 Posterior mediastinum
   (a) Neuroblastoma.
   (b) Ganglioneuroma.

(c) Duplication
(d) Coarctation
(e) Aneurysm

PREOPERATIVE MANAGEMENT

Treatment of any pulmonary complications present

POSTOPERATIVE MANAGEMENT

1 Antibiotics
2 Water seal drainage until lung expanded as demonstrated by x-ray and tube no longer draining
3 Oxygen therapy for as long as necessary
4 Endotracheal and/or bronchoscopic removal of secretions to maintain patent airway Occasionally tracheotomy necessary
5 Fluids and diet as indicated for age, postnausea Parenteral fluids usually necessary for first 24 hours

COMPLICATIONS

Rare

MITRAL STENOSIS (CONGENITAL AND ACQUIRED)

REQUIRED STUDIES

Congenital mitral stenosis is rare and commonly associated with fibroelastosis Acquired mitral stenosis on the other hand is much more common in children, yet seldom presents the clinical criteria of advancing disability indicated for surgery Correction of rheumatic mitral stenosis in children is withheld if possible until early adult life because of the possibility of recurring episodes of rheumatic fever

1 Physical signs of tight mitral stenosis
2 X-ray and fluoroscopic studies (enlarged left atrium and right ventricle)
3 Electrocardiogram (right ventricular preponderance)
4 Sedimentation rate
5 Antistreptolysin titer
6 C reactive protein determination

ELECTIVE STUDIES

Right and/or left heart catheterization

DIFFERENTIAL CONSIDERATIONS

Cor triatriatum

PREOPERATIVE MANAGEMENT

1 Control of heart failure
2 Exclude active rheumatic infection.
3 Exclude associated significant mitral insufficiency
4 Exclude associated major disease of tricuspid or aortic valves
5 Exclude subacute bacterial endocarditis
6 Ascertain electrolyte levels if patient has been on sodium restriction
7 Antibiotic therapy

OPERATIVE OBJECTIVES AND METHODS

The objectives and methods of opening the mitral valve with minimum regurgitation are similar in all respects to those in adults and the results equally satisfactory

POSTOPERATIVE MANAGEMENT

1 Cardiac management to forestall or control failure.
2 Expansion of lung and evacuation of pleural effusion by closed tube chest drainage
3 Antibiotic therapy
4 Oxygen therapy

COMPLICATIONS

1 Heart failure (medical management—digitalis, low salt etc.)
2 Hemothorax (thoracentesis enzymes intercostal drainage tube)
3 Possible exacerbation of rheumatic activity (medical management—salicylates, bed rest etc.)

PATENT DUCTUS ARTERIOSUS

REQUIRED STUDIES

This is one of the acyanotic congenital heart lesions with increased pulmonary blood flow Diagnosis established on basis of

increased pulse pressure with characteristic continuous "machinery" murmur in the second left interspace Exceptions are in infants where only systolic murmur may be heard The murmur may be atypical if the ductus flow has reversed In this case differential cyanosis (present in feet, absent in hands) may be noted Diagnosis should be suspected in any infant with heart failure

1 X-rays and fluoroscopy
   (a) Increased vascular markings
   (b) Left ventricular and left auricular enlargement
   (c) Right ventricular enlargement frequent in infants
2 Electrocardiogram.
   (a) Normal
   (b) Left ventricular preponderance occasionally
   (c) Right ventricular hypertrophy occasionally in infants and those with reversed flow

ELECTIVE STUDIES

1 Cardiac catheterization—in clinically doubtful cases
2 Aortography, retrograde—in infants with undiagnosed heart failure

DIFFERENTIAL CONSIDERATIONS

1 Aortic-pulmonary "window"
2 Interatrial or interventricular septal defect (in infants)

PREOPERATIVE MANAGEMENT

1 Treat heart failure if present
2 Treat subacute bacterial endocarditis if present

OPERATIVE OBJECTIVE AND METHODS

Closure of ductus by
1 Division and suture
2 Multiple ligation
3 Do not operate if reversed ductus with predominate right to-left shunt present In borderline cases, perform thoracotomy and temporarily occlude ductus If heart rate does not increase unduly or pulmonary artery pressure rise significantly, proceed as above If either of these complications occur during temporary occlusion, lesion is inoperable and should be left alone

POSTOPERATIVE MANAGEMENT

1 Assurance of adequate blood replacement
2 Antibiotic therapy
3 Oxygen therapy
4 Achieve full expansion of lung and evacuation of pleural fluid by chest tube, closed drainage
5 Continue cardiac management and observe carefully for on set of heart failure

COMPLICATIONS

Rare, except heart failure in far advanced cases (medical man agement—digitalis, low salt, etc.)

PECTUS EXCAVATUM

REQUIRED STUDIES

1 History of low exercise tolerance, inability to "keep up constant bronchial infections
2 Physical examination
   A stable rib cage and fixed deformity

ELECTIVE STUDIES

1 Electrocardiogram.
2 Bronchoscopy and bronchography
3 Skull films for possible associated craniosynostosis

DIFFERENTIAL CONSIDERATIONS

None except to seek for underlying upper respiratory obstructive cause for condition.

PREOPERATIVE TREATMENT AND ORDERS

1 Antibiotics
2 Cut-down in leg

POSTOPERATIVE MANAGEMENT

Orders

1 Fluids and diet as tolerated postnausea.
2 Stop intravenous fluids as soon as alimentation well established

3 Antibiotics by weight
4 O_2 and humidity till respirations stabilized and any paradoxical respirations gone
5 Chest drainage (water seal or low suction) for 3-5 days if pleural cavity entered at operation

Dressings Nothing unusual

Studies

1 Portable chest the morning after surgery
2 Red blood count and hemoglobin morning after surgery

COMPLICATIONS

1 Fluid collection in wound (needle aspiration)
2 Pericarditis, rare (aspiration as necessary for tamponade)
3 Pleural effusion (nothing except thoracentesis, if large)
4 Severe paradoxical respiration (strap for support)

PULMONIC VALVULAR STENOSIS

REQUIRED STUDIES

So-called pure pulmonic valvular stenosis is an acyanotic type of heart anomaly until cyanosis occurs when right heart pressures get above left and force a right-left shunt (usually after the age of ten) Significant physical sign is decreased or absent P_2

1 X-ray and fluoroscopic studies (evidence of decreased pulmonary blood flow, usually a good pulmonary artery shadow, enlarged right ventricle)
2 Electrocardiogram (right axis deviation and right ventricle hypertrophy)

ELECTIVE STUDIES

Cardiac catheterization studies

DIFFERENTIAL CONSIDERATIONS

1 Interatrial septal defect (in acyanotic child)
2 Tetralogy of Fallot (in cyanotic child)
3 Ebstein's disease of tricuspid valve

PREOPERATIVE MANAGEMENT

Treatment of heart failure when present

OPERATIVE OBJECTIVES AND METHODS

Correction of the valvular stenosis is most often sought by the Brock technic of transventricular valvulotomy Direct approach to the valve through the pulmonary artery has been successfully carried out, using hypothermia or employing extracorporeal circulation for oxygenation

POSTOPERATIVE MANAGEMENT AND ORDERS

1 Assurance of adequate blood replacement
2 Antibiotic therapy
3 Oxygen therapy
4 Achieve full expansion of lung and evacuation of pleural fluid by chest tube closed drainage
5 Continue cardiac management and observe carefully for onset of heart failure

COMPLICATIONS

Heart failure (medical management—digitalis low salt, etc.)

RIB TUMORS

REQUIRED STUDIES

1 These tumors are usually diagnosed because of pain and/or a mass May be primary bone or cartilage tumors
2 Chest x rays detailed x rays of the lesion, bone survey for evidence of multiple lesions
3 Careful review of symptoms investigating evidence of primary lesion with secondary rib involvement
4 Renal studies

ELECTIVE STUDIES

None

DIFFERENTIAL CONSIDERATIONS

1 Chondrosarcoma.
2 Benign enchondroma
3 Myeloma.
4 Metastatic malignancy

5 Ewing's
6 Tuberculosis

PREOPERATIVE MANAGEMENT

No special treatment

OPERATIVE OBJECTIVES AND METHODS

Block resection of chest wall if malignancy exists May be necessary to use dermal graft, tantalum mesh or other methods to reconstruct chest wall Partial pulmonary resection may be necessary for direct invasion

POSTOPERATIVE MANAGEMENT

1 Antibiotics
2 Water seal drainage until lung expanded as demonstrated by x-ray and tube no longer draining
3 Oxygen therapy for as long as necessary
4 Endotracheal and/or bronchoscopic removal of secretions to maintain patent airway Occasionally tracheotomy necessary
5 Fluids and diet as indicated for age, postnausea Parenteral fluids usually necessary for first 24 hours

COMPLICATIONS

1 Danger of flail chest if extensive resection was necessary (stabilization of rib cage by pressure dressing Tantalum mesh may be necessary for herniation)
2 Serosanguinous accumulations (aspiration and pressure dressing)

STERNOCLEIDOMASTOID FIBROMA (DERMOID)

(A) REQUIRED STUDIES

Physical examination makes the diagnosis—firm mass in SCM muscle in early weeks of life with wry neck, cranial and facial asymmetry

(B) ELECTIVE STUDY

Cervical spine x-rays for Klippel Feil or hemivertebrae

(C) DIFFERENTIAL CONSIDERATIONS

(1) Aberrant thyroid nodule —carcinoma.
(2) Branchial cleft remnant
(3) Dermoid cyst
(4) Lymphadenopathy

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Nothing by mouth for 4 hours preoperatively
(2) Routine preoperative medication (see Chapter 3 p 35)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
  a) Fluids and diet as desired postnausea.
  b) Home 24 48 hours postoperatively
(2) *Dressings* Stitches out fifth postoperative day
(3) *Exercises* Daily full neck rotation exercises beginning tenth postoperative day for 4 6 weeks
(4) *Complications* None

TETRALOGY OF FALLOT

REQUIRED STUDIES

This is a congenital, cyanotic heart condition with decreased pulmonary blood flow and a right to-left shunt through dextroposed aorta with interventricular septal defect Clinical picture is of early cyanosis paroxysmal anoxic attacks, clubbing of fingers and toes, squatting, low exercise tolerance

1 X ray and fluoroscopy (a boot shaped heart with decreased vascularity of lungs and right ventricular enlargement)
2 Electrocardiogram (right ventricular hypertrophy)

ELECTIVE STUDIES

None.

DIFFERENTIAL CONSIDERATIONS

1 Tricuspid atresia.
2 Pulmonary valvular stenosis

3 Ebstein's disease of tricuspid valve
4 Transposition of great vessels (in infants)
5 Truncus arteriosus
6 Single ventricle with pulmonic stenosis

PREOPERATIVE MANAGEMENT

1 Morphine and oxygen for anoxic attacks
2 Occasionally phlebotomy to correct polycythemia and prevent cerebral thrombosis
3 Adequate hydration to prevent thrombosis
4 Control all infections by lessening exposure, antibiotics, etc

OPERATIVE OBJECTIVES AND METHODS

1 Shunt operations to increase pulmonary blood flow
 (a) Blalock procedure—subclavian artery-pulmonary artery anastomosis
 (b) Potts' procedure—aortic-pulmonary anastomosis
2 Direct operations to relieve pulmonary blood flow obstruction.
 (a) Brock operation for valvular stenosis if present
 (b) Resection of infundibular stenosis if present
3 Complete repair
 Now becoming possible to remove obstruction to pulmonary blood flow and close the interventricular septal defect simultaneously with aid of artificial heart-lung May (?) be possible with aid of hypothermia

POSTOPERATIVE MANAGEMENT

1 Assurance of adequate fluid replacement to lessen chance of thrombosis
2 Antibiotic therapy
3 Oxygen therapy
4 Achieve full expansion of lung and evacuation of pleural fluid by chest tube, closed drainage
5 Continue cardiac management and observe carefully for onset of heart failure

COMPLICATIONS

1 Thrombosis of anastomosis (no treatment except perform another systemic pulmonary shunt)

2 Subacute bacterial endocarditis (massive antibiotics)
3 Heart failure if aortic pulmonary fistula too large (digitalis revise shunt)

THYROGLOSSAL CYST

(A) REQUIRED STUDIES

Physical finding of a midline cystic mass between thyroid gland and base of tongue usually makes the diagnosis

(B) ELECTIVE STUDIES

(1) Direct pharyngoscopy to see if any secretion from foramen cecum
(2) Radioactive iodine uptake studies if mass suspected of being "aberrant thyroid

(C) DIFFERENTIAL CONSIDERATIONS

(1) Aberrant thyroid nodule —carcinoma.
(2) Branchial cleft remnant
(3) Dermoid cyst
(4) Lymphadenopathy

(D) PREOPERATIVE TREATMENT AND ORDERS

(1) Be sure inflammatory process has subsided if infected
(2) Routine preoperative medication (see Chapter 3 p 35)

(E) POSTOPERATIVE MANAGEMENT

(1) *Orders*
  a) Oral feedings as desired postnausea
  b) Ambulatory
  c) Home 24-48 hours postoperatively
(2) *Dressings*
  a) Aspirate serosanguinous fluid in wound if large in amount
  b) Remove pressure dressing and stitches fourth to sixth postoperative day
(3) *Complication* Recurrence (reoperate)

TRANSPOSITION OF GREAT VESSELS

REQUIRED STUDIES

The aorta rises from the right ventricle and the pulmonary artery from the left ventricle. Life depends upon presence of associated defects (interventricular septal defect, interatrial septal defect, patent ductus) which permit exchange of blood between otherwise separate circulations.

1. X-rays and fluoroscopy (superior mediastinum narrow in posteroanterior view, wide in lateral view)
2. Electrocardiogram (right ventricular hypertrophy)

ELECTIVE STUDIES

1. Angiocardiography
2. Cardiac catheterization

DIFFERENTIAL DIAGNOSIS

1. Eisenmenger's complex
2. Single ventricle
3. Complete transposition of pulmonary veins
4. Tetralogy of Fallot

PREOPERATIVE MANAGEMENT

Treat heart failure if present

OPERATIVE PROCEDURES

1. To increase mixing of blood by
   (a) Creating an interauricular septal defect
   (b) Adding a systemic-pulmonary arterial shunt if there is decreased pulmonary blood flow
   (c) Transposing systemic and pulmonary veins
2. To retranspose great vessels—seems destined to fail because of coronary circulation which arises from vessels coming from right ventricle
3. To revise atrial septum so that systemic veins and coronary sinus drain to left auricle, pulmonary veins to right auricle by creating a new interauricular septum. Procedure still experimental but offers considerable promise

POSTOPERATIVE MANAGEMENT

1 Assurance of adequate blood replacement
2 Antibiotic therapy
3 Oxygen therapy
4 Achieve full expansion of lung and evacuation of pleural fluid by chest tube closed drainage
5 Continue cardiac management and observe carefully for onset of heart failure

COMPLICATIONS

Pulmonary edema and heart failure (no effective treatment when caused by operation digitalis O low salt used)

TRICUSPID ATRESIA

REQUIRED STUDIES

Congenital malformation of cyanotic type in which right ventricle is underdeveloped or absent Atresia of tricuspid valve occurs coincidentally associated with some form of stenosis of pulmonary outflow tract and always associated with interatrial septal defect in any infant born alive

1 X ray and fluoroscopic studies (evidence of reduced pulmonary flow absent pulmonary artery shadow and left ventricular hypertrophy)
2 Electrocardiogram (only instance of cyanotic heart disease with rare exceptions showing left ventricular preponderance)

ELECTIVE STUDIES

1 Angiocardiography
2 Cardiac catheterization—in clinically doubtful cases

DIFFERENTIAL CONSIDERATIONS

1 Tetralogy of Fallot
2. Single ventricle

PREOPERATIVE MANAGEMENT

1 Treatment of heart failure when present.
2 Adequate hydration to reduce risk of vascular thromboses

3 Morphine and oxygen to control anoxic episodes
4 Occasionally phlebotomy if polycythemia is severe

OPERATIVE OBJECTIVES AND METHODS

The problem of correction of the anomalies encountered has not been satisfactorily solved The current practice entails the creation of a systemic aortic-pulmonary artery shunt In some instances it is necessary to produce an additional interatrial septal defect

POSTOPERATIVE MANAGEMENT AND ORDERS

1 Assure adequate hydration
2 Antibiotic therapy
3 Oxygen therapy
4 Continue cardiac management
5 Achieve full re-expansion of lung

COMPLICATIONS

1 Heart failure (medical management—digitalis, low salt, etc)
2 Thrombosis of anastomosis (create another systemic-pulmonary shunt)

VASCULAR RING

REQUIRED STUDIES

Vascular ring is an abnormality of the aortic arch or great vessels which produces pressure on trachea and/or esophagus Many are without symptoms but others present the picture of stridor, repeated respiratory infection, feeding problems, and failure to gain weight

1 X-ray and fluoroscopic studies (esophogram displays characteristic filling defect at level of aortic arch, tracheogram often discloses narrowing of lumen at same site)

ELECTIVE STUDIES

1 Angiocardiography in some instances
2 Esophagoscopy

DIFFERENTIAL CONSIDERATIONS

1 Mediastinal tumors
2 Other types of vascular anomalies surrounding arch

3 Laryngomalacia
4 Esophageal stenosis
5 Inflammatory disease of larynx or trachea

PREOPERATIVE MANAGEMENT

No special considerations

OPERATIVE OBJECTIVES AND METHODS

Relief of pressure by division of the lesser component of encircling ring with attachment of anterior portion to sternum

POSTOPERATIVE MANAGEMENT

1 Assurance of adequate blood replacement
2 Expansion of lung and evacuation of pleural fluid

COMPLICATIONS

1 Voice changes (usually regresses spontaneously)

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CHAPTER 10

Orthopedic

ALBERT B FERGUSON JR

SINCE orthopedic surgery is principally elective and reconstructive, exceptional care must be taken to rule out unsuspected disease preoperatively Such disease may affect the patient as a surgical risk to the point where operation is inadvisable.

The history must be complete with particular emphasis on the Systems Review past history including previous operations and family history Diabetes unexplained anemia, congenital heart disease, rheumatic fever hemophilia, or inaccurate diagnosis of an underlying neurologic condition are particular pitfalls Petit mal seizures and other disturbances of the sensorium must be picked up investigated and the etiology known prior to operation

The physical examination in addition to the local examination of the involved part must bring out the patient s ability or inability to maintain adequate oxygenation during anesthesia A point likely to be neglected is a diminished respiratory reserve. The vital capacity should be known Lack of cardiac reserve may be deduced from the patient s daily activities and should be investigated thoroughly Evidence pointing to anemia, hemorrhagic diathesis and unusual vascular phenomena calls for further work up before surgical clearance is given Enlarged liver and spleen, when noted must be explained

The routine laboratory workup includes hemoglobin and hematocrit determinations, white blood count and smear A complete urine examination is a necessity with follow-up of suspicious findings An acetone determination is valuable preoperatively

It is impossible to segregate orthopedic operations by diseases Orthopedic indications for foot reconstruction, for example, vary from case to case, and all possibilities cannot be covered without being so detailed as to go beyond the scope of this manual For that reason pre and postoperative considerations are given in terms of anatomic regions

Whether a triple arthrodesis or a tendon transplant is performed, care regarding preservation of the foot is much the same in order to secure a satisfactory result The elements common to all procedures in the anatomic region have been outlined

THE FOOT

PREOPERATIVE

1 Weight-bearing anteroposterior and lateral view roentgenograms of both feet
2 Phisoderm wash daily to foot for week preceding surgery
3 Muscle examination where soft tissue surgery is involved, recorded in detail on patient's chart
4 Photograph
5 Shave leg in operating suite anteroom

AT SURGERY

1 Sandbag under hip of involved leg
2 Tourniquet on thigh
3 Sterile sandbag to support foot
4 The leg is elevated following preparation and application of stockinet Pooled blood is pushed from the leg by an Esmarch bandage wrapping and the tourniquet inflated

POSTOPERATIVE

1 Cast holding foot in correct position—usually including thigh Toes must be visualized
2 Elevation in double slings supported by traction weights on overhead frame
3 Close observation of circulatory state in toes The speed of

return of the circulation in the subungual bed following pressure is a helpful means of evaluation

RECONSTRUCTION AT THE KNEE

PREOPERATIVE

1 Phisoderm wash daily for one week preceding surgery
2 Aspiration of fluid if indicated for substantiation of diagnosis.
3 Anteroposterior lateral and tunnel views of the knee (Tunnel view is an anteroposterior view with the knee in forty five degrees of flexion) A tangential view of the under surface of the patella may also be indicated
4 The patient is started on quadriceps setting exercises Ability to make the quadriceps contract individually at will is a prerequisite to surgery
5 Laboratory work should include sedimentation rate and adequate skin tuberculin test

AT SURGERY

1 The use of a pneumatic tourniquet is necessary to adequately visualize all possible pathology in the knee The tourniquet is placed on the thigh prior to preparation of the skin The skin is prepared from the tourniquet to the ankle The foot and lower leg are encased in a sterile towel and a stockinet run over the sterile area to the tourniquet level The leg is then elevated and wrapped in an Esmarch bandage, beginning at the toes The tourniquet is then inflated and the Esmarch bandage removed
2 In instances in which reconstruction rather than biopsy or excision has been the nature of the operation, the patient is immobilized in a long leg plaster cast, including the foot to preserve the reconstruction position

POSTOPERATIVE

1 Pressure uniformly applied to the joint is valuable in minimizing postoperative fluid accumulation A wrapping of loose mechanics waste and elastic bandage made sufficiently bulky to limit knee motion assures comfort for the patient
2 Quadriceps exercises are started on the first postoperative

day Setting of the muscle is done initially As postoperative symptoms subside, knee flexion is added in the compression dressing The massaging effect of the dressing aids in eliminating postoperative edema

3 The heel should be lifted clear of the bed with the knee extended by the patient before allowing him on crutches

4 Crutches with partial weight bearing are used until quadriceps function returns to normal

THE HIP

PREOPERATIVE

1 Traction, if it has been applied in preoperative care, should be carefully inspected to make sure that adhesive dressing does not cover the side to be operated on

2 Phisoderm wash to the area daily prior to surgery

3 Adequate roentgenograms, including acetabular views as well as anteroposterior and lateral films

4 Aspiration of the hip if indicated for confirmation of diagnosis

AT SURGERY

1 Sandbag under the hip to be operated on Preparation of the leg from nipple line to midcalf and medial to the umbilicus

2 The unprepared lower calf and foot are encased in sterile sheets and stockinet The preparation of the leg so that it can be moved freely in all planes is important, when not done, the ability to expose and carry out an adequate procedure is limited

POSTOPERATIVE

1 Where absolute maintenance of position is necessary a hip spica incorporating both legs is essential

2 Where motion is desired the legs are placed in traction Balanced traction with leg suspended in a Thomas ring splint allows early subsidence of muscle spasm and the institution of active motion Split Russell traction, while not allowing quite the same freedom of motion, keeps the leg in the desired position

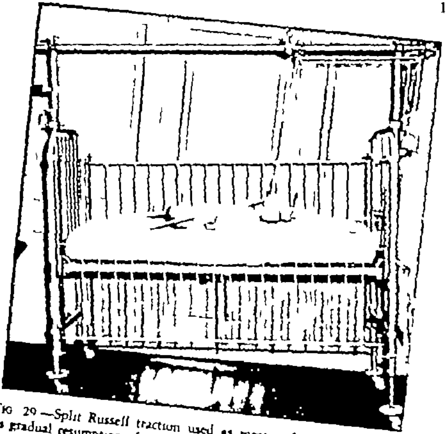


FIG 29.—Split Russell traction used as means of immobilization Allows gradual resumption of motion

3 Children in casts particularly in the infant age group need to be placed on a Bradford frame The frame keeps the head end elevated Plastic material inserted inside the cast is led through an opening in the frame to the bedpan beneath Such an arrangement, when carefully carried out eliminates soiling of the cast

THE SPINE

PREOPERATIVE

1 Operation is frequently done in a plaster body cast The anesthetist should be familiar with the patient and the mechanical position in which he will be under anesthesia
2 Preoperative studies include vital capacity routine laboratory work, electrocardiogram, and cardiac consultation.

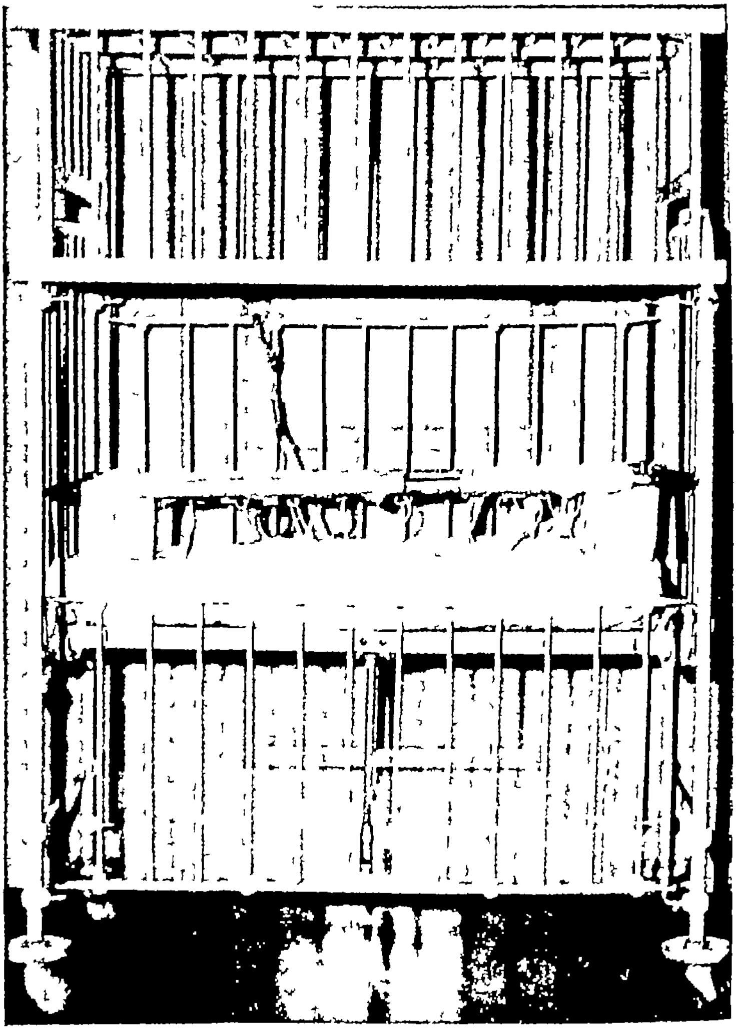


FIG 30—Bradford frame setup for children in body casts Head is elevated above pelvis and plastic drapery carried from cast to bedpan, placed beneath the opening in the frame

3 Due to the diminished respiratory and cardiovascular reserve in these patients the hemoglobin and hematocrit level should be exceptionally high to make up for other deficiencies
4 Administration of iron may be of value in the weeks of hospitalization prior to surgery for scoliosis. In borderline cases a preoperative blood transfusion may be indicated

AT SURGERY

1 Folded towels are placed under each pectoral area allowing the rib cage to be suspended between them as the patient is turned to the prone position A third folded towel beneath the pubis and ilia allow the abdomen to take part in the respiratory exchange without handicap from pressure Allowing the thighs to flex by dropping the extremity end of the table will flatten the spine the desirable degree

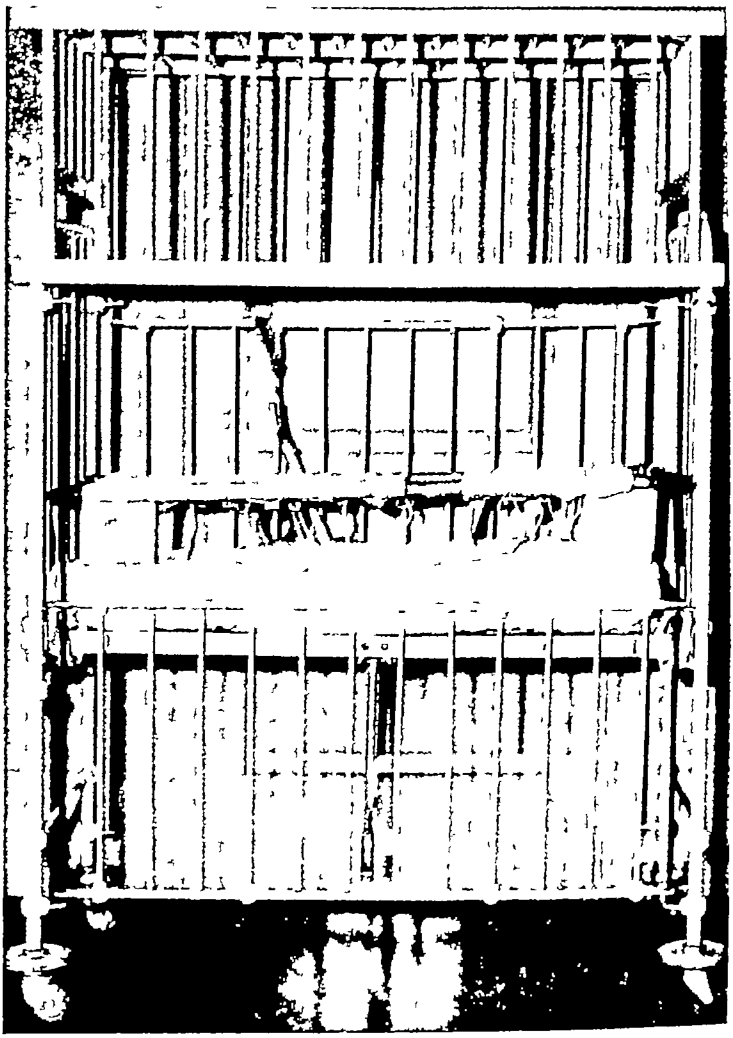
POSTOPERATIVE

1 These procedures are extensive, with considerable blood loss replacement being a usual accompaniment to the operation
2 The patient is placed in a prone position and the blood tends to pool ventrally Patients who are immediately turned on the back following the procedure have in some instances died
3 If the pulse and blood pressure are stable the patient is turned up one quarter of the way The pulse and blood pressure are taken over a 15 minute period if stable a second quarter turn brings the patient up on the side. The procedure of observation is then repeated with turns at 15 minute intervals if the patient is stable, until he may safely lie on the back
4 Repetition of laboratory work the following day is helpful in evaluating further postoperative therapy indications

THE SHOULDER

PREOPERATIVE

1 Daily cleansing of the operative area.
2 Roentgenographic studies, including humerus in varying



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4 Repetition of laboratory work the following day is helpful in evaluating further postoperative therapy indications

THE SHOULDER

PREOPERATIVE

1 Daily cleansing of the operative area.
2 Roentgenographic studies, including humerus in varying

degrees of rotation and a tangential view of the acetabulum where necessary

3 Where accurate positioning must be maintained postoperatively, as with shoulder fusion, the spica must be made preliminary to surgery It is bivalved and lined and a roentgenogram taken with the patient in plaster to check the accuracy with which the desired position was obtained.

AT SURGERY

1 Fowler's position is used with pad behind shoulder
2 Endotracheal anesthesia
3 The arm draped free and enclosed in sterile stockinet so that it may be easily rotated

POSTOPERATIVE

1 Arm in traction or plaster spica or, in the event of anterior shoulder joint reconstruction, in immobilizing device such as sling and swathe to keep the arm adducted and internally rotated
2 Sensation and circulation periodically checked during the first 24 hours

FOREARM AND HAND

PREOPERATIVE

1 Accurate muscle evaluation and sensory test
2 Roentgenogram of part to be operated on

AT SURGERY

1 Application of pneumatic tourniquet
2 Routine preparation with stockinet
3 The patient's hand is held on arm board with molded lead to hold down uninvolved fingers The exact device is unimportant, but some apparatus is needed to control and position the hand adequately while operating

POSTOPERATIVE

1 Compression with bulky dressing is essential to prevent hematoma formation

2 The plaster cast used for immobilization is kept elevated for the first 48 hours, often with double slings

3 Persistent discomfort poor circulation, and hypesthesia must be investigated and the cause relieved

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CHAPTER 11

Neurosurgical

ANTHONY F SUSEN

CRANIOSYNOSTOSIS

REQUIRED STUDIES

1 Skull x-rays to confirm diagnosis
2 Check for other congenital abnormalities—especially in coronal craniosynostosis-heart disease, choanal atresia, and so on

ELECTIVE STUDIES

1 Photographs
2 Psychometric examination

DIFFERENTIAL CONSIDERATIONS

1 Asymmetry of skull seen in motor inactivity—usually secondary to mental retardation
2 Molding of head secondary to delivery
3 Parietal bossing of skull in rickets
4 Microcephaly

PREOPERATIVE TREATMENT AND ORDERS

1 Feedings stopped 6 hours prior to surgery
2 Preoperative medication for age and weight 1 hour prior to surgery (see Chapter 3, p 35)

3 Total careful head shave shortly before surgery
4 Greasing with A&D ointment of forehead and face when in head-down position in headrest to prevent pressure sores
5 Start blood transfusion at time of scalp preparation, by cut down preferably

POSTOPERATIVE MANAGEMENT

1 *Orders*
 (a) Pulse and respirations every 15 minutes until stable then every hour for 6 hours then every 2 hours
 (b) Temperature every hour rectally if above 100 otherwise every 4 hours
 (c) Specific antibiotics
 (d) Intravenous 10 cc. blood/lb plus estimated loss, then 25 cc saline flush, then 30-50 cc 5 per cent D&W/lb per 24 hours until oral feedings take over
 (e) Five per cent D&W orally to formula as tolerated
 (f) Aspirin 0 3 Gm per rectum as required every 6 hours for temperature over 102 rectally
 (g) Alcohol sponges for temperature over 103
 (h) Turn every 2 hours
 (i) Check blood count 4 hours postoperatively and give more blood if there is any question
2 *Dressings*
 (a) Avoid tight circular dressings
 (b) Local elastoplast or tape compression advisable
 (c) Protective head dressing till bone bridging occurs A football helmet may be useful
3 *Studies*
 (a) Skull x rays every 6 to 12 months to determine amount of bone bridging
 (b) Psychometric examination
 (c) Photographs
4 *Complications*
 (a) Subgaleal hematomas usually reabsorb after 1 to 2 weeks Aspiration is rarely needed
 (b) Infections are rare but when present require drastic removal of all polyethylene before healing can occur

ENCEPHALOCELES

REQUIRED STUDIES

1 X-ray of skull and chest
2 Ventriculogram frequently reveals an abnormal brain and suggests a guarded prognosis

ELECTIVE STUDIES

1 Photographs
2 Psychometric examination
3 Electroencephalogram

DIFFERENTIAL CONSIDERATIONS

1 May occur intranasally and be confused with a nasal polyp
2 Dermoids and other scalp tumors with defects in the skull

PREOPERATIVE TREATMENT AND ORDERS

In general, these lesions can be removed at a much earlier period of life than spinal meningoceles, but only after the danger of hydrocephalus is past Surgery usually occurs at 6-12 weeks of life

1 Phisoderm wash daily for 3 days
2 Stop feedings 6 hours before operation
3 Preoperative medication for age and weight (see Chapter 3, p 35)
4 Shave head just before operation

POSTOPERATIVE MANAGEMENT

1 *Orders*
 (a) Pulse and respirations every 15 minutes until stable, then every hour for 6 hours, then every 2 hours
 (b) Temperature every hour rectally if above 100, otherwise, every 4 hours
 (c) Specific antibiotics
 (d) Intravenous 10 cc blood/lb plus estimated loss, then 25 cc saline flush, then 30-50 cc 5 per cent D&W lb per 24 hours until oral feedings take over
 (e) Five per cent D&W orally to formula as tolerated
 (f) Aspirin 0 3 Gm per rectum as required every 6 hours for temperature over 102 rectally

(g) Alcohol sponges for temperature over 103
(h) Turn every 2 hours
(i) Irregular and poor respirations may occur with occipital lesions if much brain tissue is involved and measures for respiratory assistance must be available

2 *Dressings* Nothing unusual

3 *Studies*
(a) Regular follow up
(b) Photographs
(c) Psychometric examination
(d) Electroencephalogram

4 *Complications*
(a) Hydrocephalus if it occurs is usually obstructive in type, and is difficult to treat Nevertheless, the type and severity must be evaluated
(b) Pseudoencephaloceles may occur at the site if a tight dural closure was not effected or if the dura was thin and bone opening not closed They usually do not require treatment

HEAD INJURIES

REQUIRED STUDIES

1 Evaluation of airway
2 Determine shock status
3 General evaluation for associated injuries
(a) Intrathoracic or abdominal hemorrhage
(b) Pneumothorax.
(c) Skeletal fractures
4. Periodic measurement of vital signs
Slowing pulse and rising blood pressure indicate increasing intracranial pressure usually bleeding
5 Periodic evaluation of neurologic status
(a) Deepening state of consciousness suggests increasing intracranial pressure usually bleeding
(b) Dilated and fixed pupil to light must be considered intracranial hemorrhage until proved otherwise
(c) Progressive hemiparesis suggests intracranial hemorrhage until proved otherwise
6 Observe for depressed skull fracture and spinal fluid leak from nose ears or scalp laceration.

ELECTIVE STUDIES

1 Skull and other x-rays only when patient is out of shock and can be moved safely
2 Spinal fluid examination is of limited value and, in general, not necessary

DIFFERENTIAL CONSIDERATIONS

1 Cerebral thrombosis, embolus, or hemorrhage
2 Brain tumor

PREOPERATIVE TREATMENT AND ORDERS

1 Blood cross matched and ready
2 Preoperative medication for age and weight 1 hour prior to surgery, in consultation with anesthetists
3 Establishment and maintenance of clear airway—early tracheotomy if necessary
4 Treat shock—warmth, quiet, relief of pain, blood
5 Total head shave

POSTOPERATIVE MANAGEMENT

1 *Orders*
  (a) Clear airway essential
  (b) Frequent vital sign observation
  (c) Combat restlessness with phenobarbital
  (d) Keep head slightly elevated if airway is clear
  (e) Observe pupils and neurologic status frequently
  (f) Combat hyperthermia with aspirin per rectum and alcohol sponges
  (g) Normal amounts of intravenous fluids Gastric feedings via plastic tube should be started early if coma seems prolonged
  (h) Early physiotherapy if a motor deficit is present
2 *Dressings* Nothing unusual
3 *Studies*
  (a) Electroencephalograms at intervals are valuable
  (b) Skull x-rays
  (c) Psychometric examination if mental impairment seems present

4 *Complications*
   (a) Wound hematoma
   (b) Cerebral edema
   (c) Wound infection
   (d) Seizures

HYDROCEPHALUS

REQUIRED STUDIES

1 Serial head measurements to indicate abnormally rapid growth—steel tape measure is essential

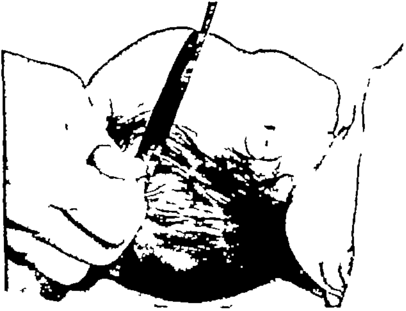

FIG. 31—A steel tape being used to measure the circumference of a suspected hydrocephalic head

2 Transillumination of head is useful for hydranencephaly and large porencephalic cysts and severe hydrocephalus with a thin cortex
3 Skull x rays regarding symmetry calcification thinning and so forth.
4 Subdural taps are essential to rule out a subdural hematoma Many subdural hematomas masquerade as hydrocephalus
5 Dye studies—ventricular and lumbar cerebrospinal fluid taps done pressures measured and samples taken for pro-

FIG 32—A spinal tap performed on an infant for study of the spinal fluid dynamics and contents

1 X-rays of entire spine and skull
2 Spinal fluid studies and dynamics
3 Myelography in face-down and face-up positions
4 Special orthopedic and urologic studies as indicated
5 Careful muscle and sensory record

ELECTIVE STUDIES

1 Photography
2 Electromyogram

DIFFERENTIAL CONSIDERATIONS

Nothing outstanding

PREOPERATIVE TREATMENT AND ORDERS

Bring urinary infection under control

POSTOPERATIVE MANAGEMENT

1 *Orders*
(a) Usually urinary catheter required for several days

(b) Any position in bed permissible
(c) Ambulate as soon as possible
2 *Dressings* Sealed dressing advisable to prevent urinary and fecal contamination
3 *Studies*
(a) Orthopedic and urologic follow up
(b) Periodic sensory and muscle examinations
4 *Complications*
(a) Wound hematoma (evacuate)
(b) Wound infection (antibiotics drainage)
(c) Urinary infection (culture antibiotics change pH urine increase fluid intake)
(d) Transient increase in intracranial pressure (spinal or ventricular taps usually control this rare occurrence)

SPINAL MYELOMENINGOCELES

REQUIRED STUDIES

These require a team effort and approach to the multiple problems involved

1 Careful evaluation of neurologic deficit
2 Careful evaluation of kidneys ureters bladder sphincters and urine
3 Orthopedic evaluation, including muscle examination—contractures dislocated hips and clubbed feet are most common problems
4 X rays of spine, chest, and skull
5 General evaluation for associated disorders—inguinal and umbilical hernias Congenital heart disease and other congenital disorders are common

ELECTIVE STUDIES

Photographs

DIFFERENTIAL CONSIDERATIONS

1 Spina bifida occulta
2 Pilonidal dimples
3 Sacrococcygeal teratomas

PREOPERATIVE TREATMENT AND ORDERS

1 Each case must be treated individually and there are no set rules In general it is best to delay operation until the dan

ger of hydrocephalus is safely passed, usually between 9 and 18 months of life

2 Local Cilkloid (plastic) dressings on the lesion, changed daily, make care simple and easy
3 Phisoderm washes preoperatively for several days are of considerable benefit in preventing infection
4 Daily subdural taps generally not to exceed 15-20 cc, until the yield is negligible (i e, brain maximally expanded)
5 Frequent small blood transfusions
6 Vitamin C
7 Operate, if possible, at time when child appears well enough to go home
8 Feedings stopped 6 hours prior to surgery
9 Preoperative medication for age and weight 1 hour prior to surgery (see Chapter 3, p 35)

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Pulse and respirations every 15 minutes until stable, then every hour for 6 hours, then every 2 hours
   (b) Temperature every hour rectally if above 100, otherwise, every 4 hours
   (c) Specific antibiotics
   (d) Intravenous 10 cc blood/lb plus estimated loss, then 25 cc saline flush, then 30-50 cc 5 per cent D&W/lb every 24 hours until oral feedings take over
   (e) Five per cent D&W orally to formula as tolerated
   (f) Aspirin 0 3 Gm per rectum as required every 6 hours for temperature over 102 rectally
   (g) Alcohol sponges for temperature over 103
   (h) Turn every 2 hours
   (i) Bradford frame, on abdomen, with head down
   (j) Foam rubber to knees and elbows to prevent chafing
2 *Dressings*
   (a) Fluff compression dressing advisable if much skin has been undermined
   (b) Protection of dressing from feces and urine by plastic flap sealed above anus
3 *Studies* Re-evaluation at regular intervals by urologic, orthopedic and neurologic surgeons

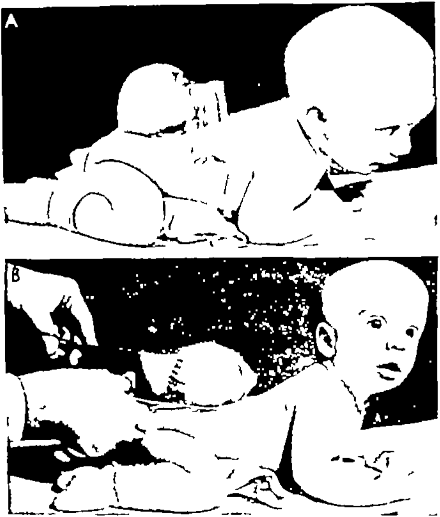

FIG 33—A plastic (Cilkloid) dressing applied to a myelomeningocele to protect and seal it until time for surgery which may be some months later

3 Feeding problem
4 Seizures
5 Failure to "do well"

PREOPERATIVE TREATMENT AND ORDERS

1 Daily subdural taps generally not to exceed 15-20 cc, until the yield is negligible (i e, brain maximally expanded)
2 Frequent small blood transfusions
3 Vitamin C
4 Operate, if possible, at time when child appears well enough to go home If membranes are found, a craniotomy is done, and they are removed
5 Feedings stopped 6 hours prior to surgery
6 Preoperative medication for age and weight 1 hour prior to surgery (see Chapter 3, p 35)
7 Total head shave just prior to surgery

POSTOPERATIVE MANAGEMENT
(Assuming Craniotomy)

1 *Orders*
  (a) Pulse and respirations every 15 minutes until stable, then every hour for 6 hours, then every 2 hours
  (b) Temperature every hour rectally if above 100, otherwise, every 4 hours
  (c) Specific antibiotics
  (d) Intravenous 10 cc blood/lb plus estimated loss, then 25 cc saline flush, then 30-50 cc 5 per cent D&W/lb every 24 hours until oral feedings take over
  (e) Five per cent D&W orally to formula as tolerated
  (f) Aspirin 0 3 Gm per rectum as required every 6 hours for temperature over 102 rectally
  (g) Alcohol sponges for temperature over 103
  (h) Turn every 2 hours
2 *Dressings*
  (a) Avoid tight circular head dressings
  (b) Drains not indicated
3 *Studies*
  (a) Subdural taps at time [illegible] ve [illegible] ented daily if fluid is found
  (b) *Ph* [illegible] graph

(c) Psychometric examination
(d) Regular follow up

4 *Complications*

(a) Recurrent subdural fluid forms if the brain has not expanded properly This is a difficult problem
(b) Seizures if they occur are usually well controlled by dilantin® and phenobarbital

INFRATENTORIAL TUMORS

REQUIRED STUDIES

1 Tuberculin and serology
2 Skull and chest films
3 Careful investigation of cauda equina function to rule out dropped metastases
4 Air study

ELECTIVE STUDIES

1 Electroencephalogram is of some value
2 Movies of ataxia, nystagmus, and gait

DIFFERENTIAL CONSIDERATIONS

1 Tubercular meningitis
2 Encephalitis
3 Frontal lobe tumors
4 Congenital posterior fossa lesion such as Arnold Chiari malformation congenital webs and stenosis of aqueduct of Sylvius
5 Abscess

PREOPERATIVE TREATMENT AND ORDERS

1 Ventricular drainage may be necessary to gradually decompress ventricles and allow child to improve its general condition
2 Massive antibiotics if abscess is suspected
3 X ray should not be given until a pathologic diagnosis is obtained, except in clear-cut brain stem or pontine tumors
4 Preoperative medication for age and weight (see Chapter 3 p 35)

FIG 35 —A head halter type of dressing used in suboccipital craniotomies to prevent neck flexion in the postoperative period

POSTOPERATIVE MANAGEMENT

1 *Orders*
   - (a) Frequent observation of vital signs, neurologic status, and wound to detect and remedy an early wound clot
   - (b) Careful oral fluid feeding until ability to swallow has been demonstrated
   - (c) Early tracheotomy if airway seems questionable
   - (d) Antibiotics if operative exposure has been prolonged
   - (e) Turn child's head with body as one unit Head flat or slightly elevated advisable to prevent forward flexion
   - (f) Control of hyperthermia by mechanical means and antipyretics
   - (g) Spinal taps for restlessness
   - (h) Observe for alimentary tract bleeding or perforation
   - (i) Normal fluid requirements
   - (j) X-ray therapy if indicated

2 *Dressings* Thick, well-supported local dressing, with a restraining head halter to prevent forward head flexion

3 *Studies* None essential

4 *Complications*
   - (a) Wound clot (evacuate)
   - (b) Spinal fluid leak (immediate suture and taps to keep pressure down)

(c) Meningitis—septic or aseptic (antibiotics and sulfadiazine)
(d) Alimentary tract bleeding or perforation (bland diet, blood surgical ligation occasionally)
(e) Pseudomeningoceles (frequent spinal taps)
(f) Hyperthermia (antipyretics, alcohol sponge fan)
(g) Impairment of swallowing reflex (no treatment)

INTRASPINAL TUMORS

REQUIRED STUDIES

1 Spinal fluid examination, including dynamics
2 X rays of entire spine
3 Myelography to demonstrate lower extent of tumor and sometimes pantopaque* via cisterna magna to determine upper level.
4 Careful chart of motor and sensory loss

ELECTIVE STUDIES

1 Evaluation of bladder function
2 Electromyogram
3 Photographs

DIFFERENTIAL CONSIDERATIONS

1 Epidural spinal abscess
2 Trauma.
3 Infectious disease i e Guillain Barré syndrome
4 Degenerative disease
5 Thrombosis anterior spinal artery
6 Poliomyelitis
7 Cerebral palsy
8 Muscular dystrophy
9 Spina bifida occulta.

PREOPERATIVE TREATMENT AND ORDERS

1 Prevent bed sores
2 Correct urinary infection in so far as possible catheter usually required
3 Use turning frame if paraplegic.

4 Tong traction advisable in high cervical laminectomy where bone involvement is suspected

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Tidal drainage usually necessary if infection has been controlled, otherwise catheter drainage
   (b) Continue on turning frame, turning every 2 hours
   (c) Orthopedic consultation regarding braces to prevent further scoliosis, kyphosis, or lordosis, where laminectomy has been extensive
   (d) Early occupational and physical therapy.
   (e) Antibiotics

2 *Dressings* Sealed dressing needed if fecal and urinary contamination is likely

3 *Studies*
   (a) Recheck myelography
   (b) X-ray treatment as indicated
   (c) Periodic urinary evaluation
   (d) Periodic motor and sensory examinations, with careful records

4 *Complications*
   (a) Wound hematoma (evacuate)
   (b) Wound infection (antibiotics, drain)
   (c) Erratic temperature changes if the high cervical area is explored (antipyretics, alcohol sponge, fan)
   (d) Urinary infection (culture, antibiotics)
   (e) Atelectasis and pneumonia if a high paraplegia is present (cough, endotracheal aspiration, antibiotics)
   (f) Paralytic ileus if a low dorsal or lumbar laminectomy (gastric suction, oxygen, intravenous fluids)

SUPRATENTORIAL TUMORS

REQUIRED STUDIES

1 Skull and chest x-rays
2 Electroencephalogram is of considerable value
3 Ventriculogram or arteriogram
4 Careful visual fields and acuity

5 Endocrine studies if parapituitary tumor is suspected
6 Tuberculin and serology

ELECTIVE STUDIES

1 Careful cerebrospinal fluid examination if indicated
2 Muscle evaluation if weakness is present

DIFFERENTIAL CONSIDERATIONS

1 Subdural hematoma
2 Cerebral thrombosis embolus or hemorrhage
3 Meningitis or encephalitis
4 Brain abscess
5 Tuberous sclerosis

PREOPERATIVE TREATMENT AND ORDERS

1 Cortisone preparation if parapituitary area is to be explored.
2 Massive antibiotics if abscess is suspected
3 Anticonvulsants if there is history of prior seizures

POSTOPERATIVE MANAGEMENT

1 *Orders*
(a) Observe for wound clot
(b) Anticonvulsant medication, especially if prior history of seizures
(c) Cortisone and ACTH regimen if parapituitary area is explored i e craniopharyngioma
(d) Antibiotics if prolonged operative exposure
(e) Observe for alimentary tract bleeding or perforation
(f) Spinal or ventricular taps as indicated
(g) Turn frequently
(h) Observe for diabetes insipidus if parapituitary region is explored and control with pitressin ®
(i) X ray therapy as indicated
(j) Normal fluid requirements
2 *Dressings* Avoid tight circular dressings
3 *Studies*
(a) Intake and output
(b) Visual fields and acuity
4 *Complications*

(a) Wound clot (evacuate)
(b) Wound infection and/or meningitis (antibiotics)
(c) Cerebral edema (hypertonic solutions, oxygen, spinal taps)
(d) Alimentary tract bleeding and perforation (bland diet, blood, surgical ligation occasionally)
(e) Seizures (dilantin,® phenobarbital)

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CHAPTER 12

Plastic

S M DUPERTUIS
and ROSS H MUSGRAVE

CLEFT LIP

REQUIRED STUDIES

1 General nutrition of infant with preferable weight of 9-12 pounds
2 Hemoglobin and red blood count
3 Bleeding and clotting time
4 Careful physical examination for other congenital anomalies, particularly congenital heart lesions and enlarged thymus

ELECTIVE STUDIES

Chest x-ray examination may reveal some pulmonary disease (e g , atypical pneumonia) which has not been diagnosed clinically

DIFFERENTIAL CONSIDERATIONS

None

PREOPERATIVE ORDERS

1 Last formula permitted 4 hours before operation and water given 2 hours before anesthesia to prevent dehydration

FIG. 36—Logan bow applied to relax upper lip tissues following cleft lip repair—moist, fine mesh gauze supported through loops of bow

2 Hypodermic of scopolamine gr 1/600 30 minutes before anesthesia if desired
3 Vitamin K if indicated
4 We infrequently order a small transfusion for mild anemia

POSTOPERATIVE

1 *Orders*
(a) Arm restraints used routinely to prevent infant touching the wound Body restraints also required in infants over 4 months of age
(b) A Logan bow is held in position by wide adhesive strips after preparing skin of cheeks with ether and tincture benzoin skin dressing The bow is applied to reduce tension on suture line
(c) Light dressing of folded fine mesh gauze size of usual Band Aid is held in position through loops of Logan bow Dressing repeatedly moistened with several drops of normal saline solution every 1 to 2 hours Changing

this gauze 4 times a day removes early crusts and discharge Nostrils cleaned with moist small cotton applicators

(d) Meticulous and frequent nursing care extremely important for good postoperative result

(e) Formula given by medicine dropper with infant in nurse's lap during feeding period Dropper feeding continued by mother at home through third week, then nipple substituted if desired

(f) Antibiotics not used routinely

2 *Dressings*

(a) All fine skin sutures removed on third postoperative day since buried catgut supports wound

(b) Silk sutures in mucous membrane remain until fifth day.

(c) Fine wire retention suture in complete clefts removed in 10-12 days

(d) Incomplete clefts discharged 10-12 days, and complete clefts 12-14 days

3 *Studies* None

4 *Complications:*

(a) Wound inflammation unusual, but when present responds readily to moist dressings and antibiotics

(b) In accidental or traumatic separation of wound, immediate resuturing indicated

(c) If wound separates from excessive tension or infection, it is wise to accept situation and treat conservatively Closure after several months is preferable to the risk of disfiguring wide scars from retention sutures

(d) Postoperative pneumonia is treated vigorously as indicated

(e) Later scar hypertrophy (about 20% of our cases) responds well to radiotherapy, if given early, secondary revision of scars usually not required

CLEFT PALATE

REQUIRED STUDIES

1 Complete blood count and urinalysis as part of routine check-up

2 Bleeding and coagulation time
3 Previous removal or filling of all carious teeth to improve oral hygiene

ELECTIVE STUDIES

1 Recording of preoperative speech on disc or tape
2 Audiometric examination if indicated
3 Cardiac evaluation to rule out congenital heart lesion
4 Group evaluation by Cleft Palate Diagnostic Clinic if such facilities available

DIFFERENTIAL CONSIDERATIONS

None

PREOPERATIVE ORDERS

1 Depending on age and size of patient preoperative medication given and food withheld as for any general anesthetic.
2 Vitamin K if bleeding time is abnormal Cross match for transfusion only if indicated

POSTOPERATIVE

1 *Orders*
(a) Arm restraints used routinely to prevent child from putting hands and fingers into mouth In older children restraints removed after recovery from anesthesia
(b) Diet of clear liquids for 2 days then milk and egg drinks added for next 5 days Soft solid food given after first week and continued until regular diet resumed following third postoperative week.
(c) Rinse mouth or give sips of water regularly after each feeding or drink
(d) Antibiotics ordered only if infection suspected
(e) In hot weather fluids given intravenously for dehydration
2 *Dressings* Usually none Occasionally flaps require support from pad of xeroform® gauze held in position by No 24 wire about molar teeth Pad and wire removed on fifth postoperative day at time of discharge
3 *Studies* Later evaluation by Cleft Palate Diagnostic Group with recordings of speech and speech therapy if required.

4 *Complications*
   (a) Postoperative ooze usually controlled by light pressure or Gelfoam packing
   (b) Continued hemorrhage requires suturing of bleeding points, usually in operating room
   (c) Traumatic separation of suture line during healing period treated by immediate resuturing of palatal flaps
   (d) Any separation from infection or slough of edges treated conservatively by mouth rinses and antibiotics Secondary closure is best delayed 4-6 months
   (e) Development of a fistula or partial separation also presents problem of later secondary repair Unless clearly traumatic in origin, never attempt an immediate closure of a palatal separation

HEMANGIOMA AND LYMPHANGIOMA

REQUIRED STUDIES

1 Complete blood count and urinalysis as part of routine check-up
2 Bleeding and coagulation time

ELECTIVE STUDIES

1 If angioma is near glabella or in midline of skull near fontanels, neurosurgical consultation requested since intracranial extension may exist
2 Ophthalmologic consultation for hemangiomas of eyelids and orbit
3 X-rays of skull as indicated

DIFFERENTIAL CONSIDERATIONS

1 In some cases elements of both hemangioma and lymphangioma may be present
2 Hematoma
3 Lipoma
4 Arteriovenous fistula or cirsoid aneurysm
5 Congenital cysts and hygroma

PREOPERATIVE ORDERS

1 Depending on age and size of patient, preoperative medication given and food withheld as for any general anesthetic

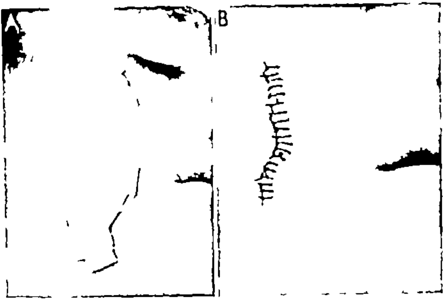

FIG. 3 —*A* dressing to supply some pressure and immobilization for small skin closure on face *B* appearance of wound with 6-0 black silk sutures at first dressing on third postoperative day when all stitches are removed.

2 When located on scalp surrounding area of hair shaved to permit adhesive dressing
3 Cross match and have blood available if large excision planned

POSTOPERATIVE

1 *Orders*
(a) Arm restraints for infants
(b) Fluid and diet as tolerated
(c) Antibiotics only if indicated
(d) Mild sedation
2 *Dressings*
(a) In skin closures fine sutures removed in 3 days on face 5 days on trunk and 8 days on extremities
(b) When skin graft required xeroform* pressure dressing removed in 5 7 days with regular change of xeroform* every 2 days for next week.
3 *Studies* Pathologic examination of specimen

4 *Complications.*
   (a) For postoperative hematoma, aspirate or treat conservatively
   (b) Infection rare, treated with antibiotics and warm compresses as indicated
   (c) Breakdown of wound should not occur if tissues handled gently during surgery, and sutures not too tight
   (d) Lost areas of graft replaced with thin split-thickness grafts after good granulation tissue has developed

DERMOID CYST OR SINUS

REQUIRED STUDIES

1 Determine cystic nature of mass by careful palpation, dermoids adherent to deep structures and not to skin
2 Aspiration of thick contents not feasible
3 Complete blood count and urinalysis as part of routine check-up

ELECTIVE STUDIES

1 Tangential skull films for bony involvement
2 Sinus tract injection with radiopaque dye

DIFFERENTIAL CONSIDERATIONS

1 Deep hemangioma or lymphangioma
2 Lipoma—unusual before puberty
3 Sebaceous cyst—rare in children and always adherent to skin
4 Meningocele
5 Fibroma
6 Sinus tract to dental root abscess

PREOPERATIVE ORDERS

1 For cysts near scalp, shave area 2 inches away from lesion to permit better postoperative dressing Eyebrow preferably not shaved, since scrubbing with facial preparation is adequate
2 If infected, antibiotics given and inflammation treated by warm, moist dressings When infection localized, com-

plete removal or destruction of cyst wall necessary to prevent recurrence

3 Bleeding and clotting time if indicated
4 For infants last formula 4 hours before anesthesia and water 2 hours before induction to prevent dehydration Preoperative medication if desired
5 In older children for local anesthesia, give barbiturate such as seconal[R] according to weight withhold preceding meal and permit water up to 2 hours before operation

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Fluid and diet as tolerated after anesthesia
   (b) In hot weather give infants 50 cc normal saline subpectorally to prevent dehydration
   (c) Antibiotics only in infected cases
   (d) Mild sedation
   (e) Early ambulation and discharge
2 *Dressings*
   (a) In infected cases when packed open remove gauze packing in 2 3 days Replace fine mesh dry gauze daily until granulations fill cavity Secondary closure can be done, or allow healing with revision of scar after 4 months
   (b) In clean cases pressure dressing taken off on third post operative day and all fine skin sutures removed
   (c) Scar supported with adhesive bridges and light protective covering for 1 week
   (d) After 2 weeks massage scar gently with lanolin and use hot moist applications only if induration is considerable
3 *Studies* None
4 *Complications*
   (a) Infected wounds rare treat by warm, moist compresses and antibiotics
   (b) Ecchymosis of eyelids is expected, but hematomas respond to aspiration or conservative treatment rarely is evacuation required
   (c) Early hypertrophy of scar controlled by light radiotherapy

SEBACEOUS CYSTS

Extremely rare in children, but if present usually located about head and neck Various studies, orders, dressings, and considerations as presented under "Dermoid Cyst or Sinus" apply to sebaceous cysts

MICROGNATHIA

REQUIRED STUDIES

1 Complete blood count and urinalysis as part of routine check-up
2 Lateral x-ray film for record purposes

ELECTIVE STUDIES

1 Bleeding and coagulation time
2 Chest films if indicated

DIFFERENTIAL CONSIDERATIONS

Possibly macroglossia or congenital atresia of pharynx

PREOPERATIVE ORDERS

1 If cyanotic, place on abdomen allowing tongue to fall forward and clear airway
2 Oxygen incubator may be required until operation
3 In extreme cyanosis immediate tracheotomy may be life saving
4 Last formula given 4 hours before elective operation and water 2 hours before anesthesia

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Suction used when necessary if any ooze along suture line of tongue-lip adhesion
   (b) Keep infant on abdomen
   (c) When sucking difficult, dropper feeding indicated for few days
   (d) Antibiotics not routine
   (e) Oxygen incubator if indicated
   (f) Tracheotomy set at bedside

2 *Dressings* Skin stay suture protected by rubber guard, removed in 10 days
3 *Studies* Experience indicates mandible usually grows to nearly normal size by age 5 after surgical separation of tongue lip adhesion in 6-12 months
4 *Complications*
   (a) Wound infection unusual
   (b) If raw surface contact of adhesion is inadequate or if tight sutures strangle tissues lip-tongue adhesion may separate
   (c) When lower incisor teeth irritate adhesion, earlier separation indicated

MICROTIA

Our method for reconstruction of the congenital crumpled auricle includes three basic operations usually started at age 4

OPERATION 1 —Excision of crumpled cartilage mass with retroposition of future lobule and lower portion of helix.

OPERATION 2 —Increasing experience indicates a carefully carved autogenous rib cartilage graft inserted in position beneath mastoid skin is best for supporting framework

OPERATION 3 —Surface skin and adherent cartilage graft with attached posterior covering of fibrous tissue elevated, and a split-thickness skin graft from abdomen applied to cover raw surfaces

An average of 4-6 months separates these operative stages and later several smaller procedures may be necessary to improve contour or add a rolled helix by a mall tubed pedicle

REQUIRED STUDIES FOR ALL THREE STAGES

Complete blood count and urinalysis as part of routine check up

ELECTIVE STUDIES

1 Otologic examination to ascertain the extent of middle and internal ear deformity
2 Stereo x rays of skull to demonstrate presence or absence of bony external canal
3 Audiology tests if child will co-operate

DIFFERENTIAL CONSIDERATIONS

None

PREOPERATIVE ORDERS

1 Scalp is shaved 1½ inches above operative site on involved side Advisable to continue shave across base of scalp posteriorly to permit postoperative adhesive bandage
2 Considering age and size of patient, routine preoperative medication given, and food withheld as for any general anesthetic For smaller procedures in older children under local anesthesia, a barbiturate such as seconal® ordered 45 minutes before operation
3 Endotracheal anesthesia scheduled for three basic operative stages

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Postoperative sedation—phenobarbital or codeine since discomfort usually mild
   (b) Antibiotics only in second stage for cartilage graft
   (c) Diet as tolerated
2 *Dressings*
   (a) Fine skin sutures usually removed by third postoperative day
   (b) Dressing after cartilage graft on fifth postoperative day with removal of sutures
   (c) After third stage, graft dressing removed in 7 days Daily change of xeroform® gauze for 1 week, then protected with dry gauze for 1 week
   (d) In subsequent operations, skin sutures always removed in 3-5 days
3 *Studies* None
4 *Complications*
   (a) Despite operating room pressure dressings, if a hematoma is found, best treated by aspiration or allowed to absorb
   (b) Rare d infections t arm, moist compr tibiotics

(c) If infected cartilage grafts usually can be saved by aspiration of pus and replacement by weak penicillin solution (1500 U per cc) twice daily for 3 or 4 days plus systemic antibiotic
(d) Small hematomas under skin grafts evacuated by incising overlying graft Areas of graft loss allowed to de

FIG. 38—Typical pressure dressing for ear or cheek procedure—cohesive gauze covering effectively stabilizes dressing.

marcate, then excised to permit granulation bed and regrafted
(e) If cartilage graft edge becomes exposed by partial separation of wound or thin scar later protruding portion of cartilage is cut away to allow skin edges to seal over remaining graft These wounds wisely protected by antibiotic ointment and dressing

SYNDACTYLISM

Separation of webbed digits practically always requires skin graft for good functional result

REQUIRED STUDIES

1 Complete blood count and urinalysis as part of routine check-up
2 X-ray of involved digits to check bony configuration.

ELECTIVE STUDIES

None

DIFFERENTIAL CONSIDERATIONS

None

PREOPERATIVE ORDERS

1 Depending on age and size of the patient, preoperative medication given and food withheld as for any general anesthetic
2 Nails of involved hand are trimmed and hand washed for 5 minutes evening preceding operation with phisohex® and water

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Elevate involved arm on one or two pillows With small child, pillow may completely encircle dressing and be pinned to it Body restraints only as required
   (b) Fluid and diet as tolerated
   (c) Antibiotics rarely used
2 *Dressings*
   (a) Original pressure dressing and xeroform® gauze over graft removed in 7-9 days All fine skin sutures out, and xeroform® gauze padded dressing changed every 2 days for next week
   (b) In full-thickness graft, abdominal skin closure dressed after 5 days with removal of all sutures Wound edges supported with adhesive strips
   (c) When split-thickness graft used, xeroform® dressing removed in 12-14 days when healing is complete
3 *Studies* Later x-rays only in cases of bony involvement
4 *Complications*
   (a) Infection rare, treat with antibiotics and wet dressings

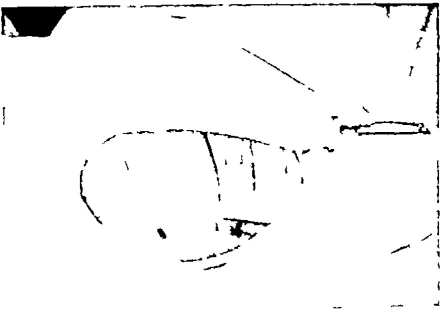

FIG 39—In small child typical pressure dressing for syndactylism immobilized on pillow

(b) Loss of significant portion of graft best treated by secondary graft on granulation surface
(c) With pressure and immobilization, hematomas are rare treatment is aspiration beneath flaps or evacuation by incising free graft
(d) Massage grafted areas later with lanolin
(e) Occasional flexion scar contracture requires later surgical correction

BURNS

EMERGENCY ROOM CARE

1 Determine nature of burn from parents flame and scald burns usually deep
2 Rapidly evaluate child s condition
3 Plan immediate tracheotomy if respiratory emergency exists from inhalation burn
4 Minor burns dressed for out patient care.
   (a) Give barbiturates for pain and fright—intravenously orally or as suppositories

(b) Cleanse surface gently with white soap and water or sterile saline
(c) Apply dry fine mesh or xeroform® gauze to burned area
(d) On extremities, well-padded dressings immobilize area for better healing
(e) Exposure treatment preferable for facial burns

5 Plan to hospitalize children with more than 5 per cent surface area of third degree burn or more than 15 per cent second degree burn
(a) Give barbiturates intravenously for pain or hysteria Avoid morphine and general anesthesia if shock is expected
(b) With beginning or anticipated shock, draw blood for studies and hematocrit, start intravenous saline pending final plan of treatment
(c) All attendants must be masked
(d) Remove or cut clothing from burned areas and cover with sterile sheet or towels
(e) Transport immediately to operating room to start calculated fluid replacement and dressings

OPERATING ROOM FOR DEFINITIVE TREATMENT

1 Weigh child or obtain recent weight for fluid requirement calculations
2 Venipuncture for hematocrit, urea, or NPN if not performed in emergency ward
3 Venous cutdown often advisable to insert plastic canula for fluids
(a) Start type-specific plasma or plasma substitute as dextran
(b) Plan definite 48-hour program of fluid replacement to prevent shock
4 Estimate extent of surface areas of second and third degree burn, draw diagram on chart
(a) Full-thickness burns difficult to delineate
(i) Any charred or blanched areas certain third degree in flame and scald burns
(ii) Anesthesia to light pinprick helps, but not accurate

(iii) Natural tendency to underestimate area of deep burn and overestimate extent of total burn

(b) Most useful method is rule of nine

Head surface area	9%
Trunk front	18%
Trunk, back	18%
Leg	18%
Arm	9%

(c) In infants and young children, consider greater per centage surface area of head to body

5 Place indwelling catheter to collect urine each hour Record as graph on chart

PLAN FOR FLUID REPLACEMENT (MOORE S PLAN)

1 Anticipated shock prevented or controlled by early adequate fluid replacement

2 In general severe burns over 25 per cent require 10 per cent of body weight as plasma in first 48 hours to replace exudate and burn edema losses

3 Regular lung and skin loss of fluid replaced with water

4 Urine loss replaced by saline

5 Give one half plasma water saline requirement intravenously in first 12 hours—remainder more slowly in next 36 hours

6 One whole blood transfusion in first 48 hours to replace red cells lost in burn hemolysis

7 Calculate actual fluid requirements and record plan on chart.

(a) Example Child with 40% burn trunk and extremities weighing 20 kg

(b) Total fluid ration for first 48 hours

2000 cc plasma for exudate and edema losses (10% weight)

1000 cc. glucose in water for lung losses

1000 cc. glucose in saline for urinary loss

4000 cc. (plus 200 cc. whole blood)

(c) Give one half total fluids first 12 hours, one fourth next 12 hours and one fourth second 24 hours

ALTERNATE FORMULA USED BY EVANS

1 Use 1 cc plasma or substitute per kg body weight for each percentage point surface burn up to 50%
2 Add same amount saline in first 24 hours
3 In second 24 hours, total intravenous fluids one half as much
4 All third degree burns receive one half plasma as whole blood
5 Calculation by this formula
   (a) Example Child with 40% burn trunk and extremities weighing 20 kg
   (b) 800 cc plasma-blood (40% × 20 kg)
   800 cc saline
   800 cc saline-plasma-blood (one half amount for second 24 hours)
   1350 cc calculated normal water requirement for 48 hours
   3750 cc requirement first 48 hours (includes 600 cc whole blood)

PRACTICAL ASPECTS OF FLUID REPLACEMENT

1 Differences in fluid requirements calculated by two formulas is not great—either probably adequate to prevent shock (Moore estimates 3000 cc daily normal fluid requirement for adults and Evans 2000 cc)
2 *Important to realize that all formulas should be used only as guides* they provide a workable plan to sustain severe burns through the period of shock, but may require changes as hourly urine output is observed closely
3 Our experience agrees with Evans—more liberal use of whole blood transfusions gives better results
4 Best practical indication that patient is receiving adequate fluid replacement is frequent correlation of symptoms and signs, the laboratory determinations, and the *urinary output*
5 Amount and specific gravity of hourly urine output single most valuable guide in fluid replacement

LOCAL CARE AND DRESSING OF BURNED AREA

1 Exposure method gives good results, but requires more careful nursing care

(a) May be preferred in hot weather and warm climates
(b) Always used on the face neck, and genitalia
(c) Usually gives poor results in circular trunk burns and burns of the hand
(d) For transportation, burns should have occlusive dressings.

2 Occlusive pressure dressings preferred for most burns well padded dressings splint and immobilize tissues during healing period
(a) General anesthesia not advisable in presence of shock and usually not necessary Oxygen by mask or nasal tube is valuable
(b) Avoid morphine sedate well with barbiturates
(c) *Gently cleanse burned surface with saline or white soap* and water
  (i) Shave hair when necessary and remove loose epithelial debris
  (ii) Overzealous débridement and cleansing of burns is discouraged
(d) Apply dressing of single layer of xeroform* or dry fine mesh gauze many compresses kerlix* or gauze rolls, and moderate even pressure with elastic bandages
  (i) Be certain pressure dressing not too tight on extremities
  (ii) Splint joints with plaster strips as indicated
(e) In infants and small children face burns necessitate use of arm restraints
(f) In deep burns of limited area, immediate excision and graft may be indicated to shorten convalescence

POSTOPERATIVE CARE AFTER RETURN TO ROOM

1 Penicillin injections ordered—oral antibiotics avoided early because of vomiting
2 Tetanus prophylaxis must be given
3 Intravenous fluids regulated for correct amount in each time interval—calculated at 15 drops per cc
4 Watch hourly urine output closely—most valuable guide to fluid replacement
  (a) Less than 10 cc. output for 3 consecutive hours indicates inadequate fluid intake (variable for size of child)

(b) More than 50 cc means overloading of circulation
(c) Hemoglobinuria carries a graver prognosis and indicates probable renal damage

5 Record pulse, respiration, and blood pressure hourly
6 Schedule daily blood counts during critical period
(a) In small children frequent hematocrits difficult to obtain and of limited value
(b) Other blood studies twice weekly or as indicated

7 Elevate burned extremities
8 For pulmonary involvement from inhalation burns or excessive intravenous electrolytes
(a) Eliminate intravenous saline component—give orally as iced half-strength fluid if possible, or by gastric tube
(b) Give intranasal oxygen or use tent
(c) Intravenous aminophylline or as suppositories may help
(d) Tracheotomy set at bedside

9 In sudden hyperpyrexia, treat vigorously by cooling—occlusive dressings may have to be removed
10 Special nursing care a necessity in early days
11 A doctor should be in constant attendance throughout critical period

SECOND TO FIFTH DAY
(Sodium retention period)

1 With adequate fluid therapy, hematocrit is stabilized
2 Patient more acutely ill with elevation of temperature
(a) Drowsiness or restlessness and mental confusion should not be treated by heavy sedation
(b) Distention with nausea and vomiting—give only ice chips and do not force feed

3 If no vomiting, give all fluids and skimmed milk frequently on second day
4 After 2 days a formula of fat, protein, carbohydrates, and vitamins is given
5 Decrease intravenous fluid as oral intake increases
(a) After initial calculated amount of plasma or plasma substitute given, continue intravenous electrolytes as indicated by laboratory tests for required daily fluid, or loss in vomiting
(b) Give small whole blood transfusions as indicated to prevent anemia

6 From third to fifth day watch for sudden diuresis
  (a) Edema fluid returns to the circulation
  (b) Drastically reduce intravenous fluids immediately
  (c) Improvement in child s general condition usually permits full oral intake
7 Dressings not changed during this period—may be reinforced or outer layer changed if necessary

FIFTH TO FOURTEENTH DAY
(Period of nitrogen loss)

1 As protein loss increases daily from sloughing tissues and wound drainage replacement by feeding of great importance.
  (a) Order high protein and caloric diet with stress formula vitamins
    (i) Children must be coaxed and urged each meal
    (ii) Request nurses devote extra time to encourage adequate intake
    (iii) Order tube feeding if necessary
      a) Required if nausea or vomiting persists
      b) Child told if next meal eaten tube omitted.
      c) No meal missed—resort to tube feeding
  (b) This formula palatable and also useful to supplement feedings later

Skimmed milk	40 oz.
Eggs	4
Beta lactose	100 Gm
Sucrose	100 Gm
Caesac	35 Gm
Orange juice	400 cc

    (i) Formula provides 2214 calories with 400 Gm carbohydrates 90 Gm proteins and 25 Gm fat
    (ii) Do not boil formula—watch for souring in warm weather
2 Give 2 to 3 whole blood transfusions weekly if indicated by laboratory reports—do not permit anemia to develop
3 Schedule NPN hematocrit and serum protein tests twice each week, and electrolytes weekly
  (a) Low sodium common but not serious
  (b) Increasing azotemia from early anoxic or previous kidney damage, guarded prognosis

4 Change antibiotic periodically to minimize drug resistance
5 Irrigate indwelling catheter twice daily, change each week
6 First dressing 7-10 days
  (a) With good sedation anesthesia usually not necessary
  (b) Care and gentleness important
  (c) Surgeon changes each dressing—extensive burns require an hour or more with adequate help
  (d) Redress with xeroform® or dry fine mesh gauze pressure
7 With child's condition stabilized at 10-12 days, consider surgical excision of part or all slough as indicated, with coverage by thin split skin graft immediately or in 3 days

THIRD WEEK TO THREE MONTHS

(Major objective to close remaining wounds with split skin grafts)

1 Continue transfusions to avoid anemia, high protein-vitamin diet, and shift antibiotics before operations often with 2-day antibiotic rest
2 Plan program of skin grafting
  (a) Aggressive approach necessary—never postpone for "ideal" period of lower temperature and better granulations
    (i) Surgically remove loosened portions of slough
    (ii) Unless burned or infected, subcutaneous fat ideal bed for grafts
    (iii) In less extensive burns, excise and graft questionable areas of deep second degree to speed healing
    (iv) When weight is lost, pad and protect bony prominences to prevent decubitus ulcers
  (b) In properly treated child with minimal infection, expect maximum take of grafts
    (i) Thin split skin grafts (8-15/1000 inches) take most readily—usually electric dermatome shortens operating time
    (ii) Treat limited donor sites with great care to permit repeat grafts
    (iii) In extensive burns judiciously divide grafting into stages
    (iv) Xeroform® pressure dressings aid immobilization of grafts

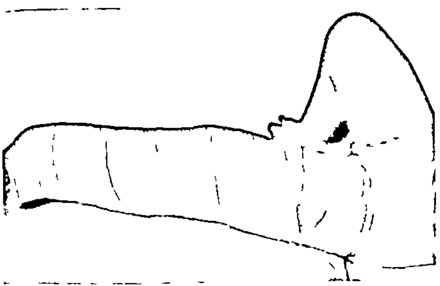

FIG 40—Occlusive pressure dressing for burn with extremity elevated on pillow

(v) Employ plaster reinforcement to immobilize extremities and elevate on pillows
(vi) Change dressing in 5 7 days and regraft small areas of loss early to speed complete healing
(vii) On donor areas moist outer dressing changed in 2 days—xeroform® inner dressing loosens in 10-12 days at complete healing
  a) For delayed healing of donor site, treat by alternating periods of moist saline and xeroform® dressings with intermittent exposure to reduce maceration
  b) Exposure treatment good in hot weather for older children

3 Advise parents regarding rehabilitation
  (a) Continue xeroform® 1 week after healing then light protective dressing for 1 2 weeks
  (b) Plan early graded ambulation and exercise
  (c) Instruct parents to massage grafts with lanolin daily and exercise stiff joints with care
  (d) Advise light x ray therapy for scar hypertrophy
  (e) Inform parents that additional definitive grafts may be required where tightness persists

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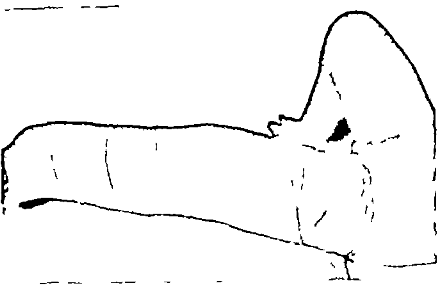

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CHAPTER 13

Urologic

S HARRIS JOHNSON III

THE SPECIFIC pathologic conditions covered are those which are most frequently encountered There is no attempt to make it all inclusive A large portion of the field of pediatric urology concerns itself with the field of diagnosis and so the multitude of major and minor anomalous and pathologic changes which may occur in the genitourinary tract of infants and children cannot be detailed

The specific surgical correction of these abnormalities varies with the method chosen but the pre and postoperative care is often the same or quite similar in each organ concerned such as kidney ureter or bladder To avoid being repetitious reference will often be made to care outlined in the discussion of another pathologic entity

KIDNEY

HYDRONEPHROSIS CONGENITAL AND ACQUIRED

REQUIRED STUDIES

1 History
   (a) May be asymptomatic particularly when bilateral
   (b) Flank pain may radiate to groin or genitals
   (c) Polyuria.

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CHAPTER 13

Urologic

S HARRIS JOHNSON III

THE SPECIFIC pathologic conditions covered are those which are most frequently encountered There is no attempt to make it all inclusive A large portion of the field of pediatric urology concerns itself with the field of diagnosis and so the multitude of major and minor anomalous and pathologic changes which may occur in the genitourinary tract of infants and children cannot be detailed

The specific surgical correction of these abnormalities varies with the method chosen but the pre and postoperative care is often the same or quite similar in each organ concerned such as kidney ureter or bladder To avoid being repetitious reference will often be made to care outlined in the discussion of another pathologic entity

KIDNEY

HYDRONEPHROSIS CONGENITAL AND ACQUIRED

REQUIRED STUDIES

1 History
   (a) May be asymptomatic, particularly when bilateral
   (b) Flank pain may radiate to groin or genitals
   (c) Polyuria

(d) Gastrointestinal disturbances

2 Physical examination
(a) Palpable mass in flank
(b) Hypertension
(c) Possible urethral meatal stricture

3 Laboratory studies
(a) Hematuria
(b) Intermittent pyuria
(c) Nonprotein nitrogen

4 Excretory urography
Functional determinant for one or both involved kidneys or for uninvolved contralateral kidney

5 Cystourethroscopy and retrograde ureteral catheterization
(a) Determination of site of obstructive uropathy
(b) Differential phenolsulfonphthalein
(c) Differential urine cultures with sensitivity tests
(d) Renal pelvic capacity
(e) Retrograde contrast pyelography for anatomic diagnosis

ELECTIVE STUDIES

1 K, Na, Cl, CO_2 combining power
2 Lumbar aortography

DIFFERENTIAL CONSIDERATIONS

1 Polycystic kidneys
2 Kidney tumor
3 Retroperitoneal tumor
4 Splenomegaly

PREOPERATIVE TREATMENT AND ORDERS

1 Severe hydronephrosis unilateral, in presence of contralateral life-sustaining function nephrectomy is indicated
(a) Type and cross-match blood
(b) Correction of electrolyte balance and anemia if necessary
(c) Cut down for intravenous fluids
(d) Preanesthetic restriction of oral intake for 3-4 hours and medication by age and weight (see Chapter [illegible], p 35)

2 Severe hydronephrosis bilateral or in absence of contralateral life-sustaining function, nephrostomy is indicated
Preoperative orders same as nephrectomy, above

3 Moderate to mild hydronephrosis, pyeloureteroplasty indicated Preoperative orders same as nephrectomy above

POSTOPERATIVE MANAGEMENT

1 Nephrectomy
   (a) *Orders*
      i) Nothing by mouth until peristalsis is adequately established
      ii) Replace blood loss by careful calculation from weighed sponges
      iii) Intravenous fluids (30-35 cc./lb /24 hrs) until adequate oral fluids are tolerated following establishment of peristalsis
      iv) Careful charting of intake and output balance
      v) Blood pressure and pulse taken and charted every hour until stabilized and then twice daily for 3 days In case of preoperative hypertension charting of blood pressure is continued until discharge
      vi) Sedation usually not required If so small doses of phenobarbital or codeine according to age and weight (see Chapter 4 pp 57 58)
      vii) Antimicrobials only if indicated by wound infection or distinctly febrile course
      viii) Ambulation by first to third postoperative day
   (b) *Dressings*
      i) Drains used only in presence of obvious infection If so removed second to fifth day
      ii) Silk sutures removed fifth to seventh day
   (c) *Studies*
      i) None immediately
      ii) Follow up on status of remaining kidney for minimum of 1 year
   (d) *Complications* Unusual
2 Nephrostomy
   (a) *Orders*
      i) Nothing by mouth until peristalsis is established
      ii) Antimicrobials as prophylaxis or as determined by urine culture and sensitivity tests
      iii) Careful record of intake and output.
      iv) Intravenous fluids—keep on high side (30-50

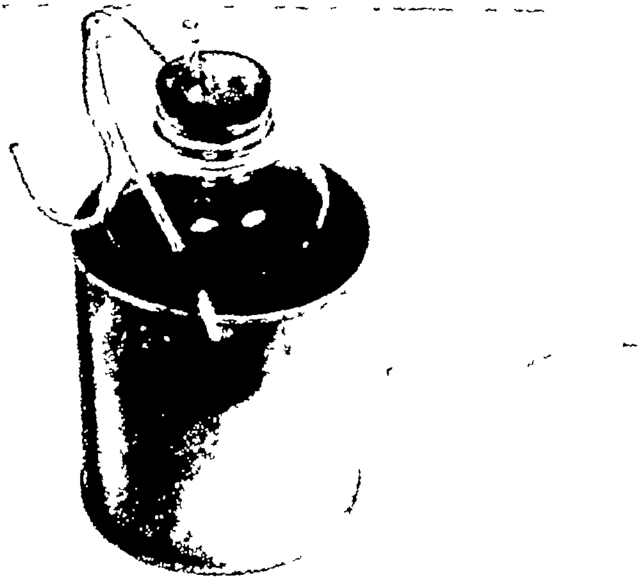

FIG 41—Sterile closed drainage system suitable for attachment to nephrostomy, ureterostomy or cystostomy tubes

cc /lb /24 hrs) until adequate output can be maintained by oral fluids

v) Careful control of electrolyte balance as indicated by blood chemistry determinations Na and K by age, size, and status of electrolyte balance (see Appendix)

vi) Nephrostomy catheter attached to sterile closed drainage system composed of plastic tubing connecting nephrostomy catheter to a clear glass container fitted with a two hole stopper (Fig 41) A short section of glass tubing is fitted into one hole and attached to the plastic tubing At no time should level of urine in bottle reach the section of glass tubing.

vii) Daily gentle irrigation of nephrostomy tube with sterile water or saline warmed to body temperature, twice daily

viii) Sulfonamide or acetylsalicylic acid therapy, dosage by age and weight, to prevent incrustation of drainage tube and calculus formation

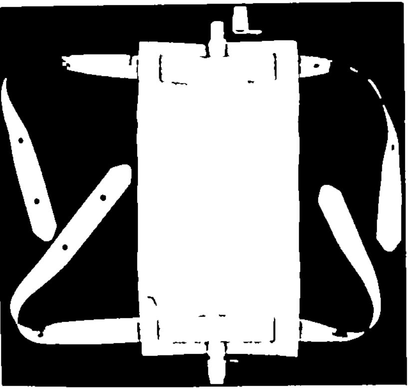

FIG 42 —Plastic urinal which can be strapped to thigh

ix) When ambulatory nephrostomy tube is attached to a plastic urinal strapped to thigh (Fig 42)

(b) *Dressings*

i) Silk sutures removed fifth to seventh day

ii) Drains removed third to fifth day

iii) Nephrostomy tube changed as required With latex tube, such as Foley urethral catheter and prevention of incrustation as noted above, necessity for change is infrequent—every 1 3 months

(c) *Studies*

i) Urographic control studies to determine degree of renal rehabilitation

ii) Follow up studies by urine culture and blood chemistry determinations

(d) *Complications*

i) Involuntary loss of nephrostomy tube (replace as quickly as possible, since fistula may close enough

in a period of a few hours to prevent nonoperative replacement of an adequate sized catheter)

ii) Calculus formation (prevention is best treatment)

iii) Infection (again prevention by prophylactic antimicrobials and scrupulously sterile care is best treatment)

3 Pyeloureteroplasty

(a) *Orders*·

i) Nothing by mouth until peristalsis is established

ii) Antimicrobials as prophylaxis or as determined by urine culture and sensitivity tests

iii) Careful record of intake and output

iv) Intravenous fluids—keep on high side (30-50 cc./lb /24 hrs) until adequate output can be maintained by fluids given orally

v) Careful control of electrolyte balance

vi) In intubation type of pyeloureteroplasty and/or when nephrostomy drainage is used, follow care of nephrostomy catheter technic outlined above

vii) Salicylamide or acetylsalicylic acid therapy, dosage by age and weight to prevent calculus formation

(b) *Dressings*

Where intubation technic was used

i) Silk sutures removed fifth to seventh day

ii) Penrose drains removed third to fifth day

iii) Plastic ureteral splint removed in approximately 21 days

iv) Nephrostomy tube removed 2-3 days later following antegrade pyelography to delineate details of pelvic and ureteral conformation following surgery

Where Hamm technic was used

i) Silk sutures removed fifth to seventh day

ii) Penrose drain removed ninth to fourteenth day, or later, when all urine drainage has ceased

(c) *Studies*

i) Repeat urinalyses and urine cultures until urine remains sterile without antiseptics for a minimum period of 3 months

ii) Follow-up urographic stud[illegible] if there is renal stabilization—minimum

(d) *Complications*
 i) Calculus formation (demands operative removal)
 ii) Gross infection (endangers operative result and usually leads to more marked stricture formation, perhaps necessitating nephrectomy to cure it)
 iii) Persistent urinary fistula (indicates obstruction be low and necessitates its correction operatively)

FUSED DOUBLE KIDNEY

REQUIRED STUDIES

1 Clinical picture is that of complicating disease e g obstruction infection, and calculus disease May be asymptomatic.
2 Laboratory studies
 (a) Urine cultures preferably differential
 (b) Nonprotein nitrogen
 (c) Differential phenolsufonphthalein
3 Urography excretory and retrograde

ELECTIVE STUDIES

Search for coexisting anomalies

DIFFERENTIAL CONSIDERATIONS

1 Renal tumor
2 Renal cyst

PRE AND POSTOPERATIVE MANAGEMENT

1 Surgery is indicated only for the correction of coexisting complications such as obstruction, infection calculus dis ease, and incontinence due to ureteral ectopy Heminephrec tomy is then procedure of choice if only one component involved Management is that as shown for nephrectomy (pp 252 253) except
 (a) Antimicrobials are used pre and postoperatively
 (b) Drains are used and removed third to fifth day
 (c) Follow up study includes observation of remaining re nal component in addition to contralateral kidney
 (d) Chief complication is damage to function of remaining segment of kidney due to operative damage to blood supply or infarction

CYSTIC DISEASE OF KIDNEY (POLYCYSTIC, MULTICYSTIC, SOLITARY)

REQUIRED STUDIES

1 History
   Pain in flank, most common in polycystic disease
2 Physical examination
   (a) Mass in flank, cystic and ballotable In polycystic disease, usually bilateral
   (b) Blood pressure may be elevated
3 Laboratory tests
   (a) Hematuria
   (b) Pyuria
   (c) Anemia in polycystic disease
   (d) Nonprotein nitrogen
   (e) Phenolsulfonphthalein
   (f) Na, K, CO_2 combining power, Cl, in polycystic disease
   (g) Urine culture with sensitivity tests
4 Urography, excretory and retrograde

ELECTIVE STUDIES

1 Injection of cyst with radiopaque media
2 Arteriogram
3 Liver function tests
4 X-ray film of lungs

DIFFERENTIAL CONSIDERATIONS

1 Malignant kidney tumor
2 Cystic degeneration of chronic nephritis
3 Neuroblastoma

PREOPERATIVE TREATMENT AND ORDERS

1 Polycystic disease
   (a) Operative treatment is seldom indicated except for intractable pain, hematuria or infection, obstruction or calculus disease Nephrectomy is contraindicated except as a lifesaving measure for hematuria uncontrolled by more conservative means Renal exposure and cyst puncture will occasionally relieve pain, control hematuria, and improve renal function

(b) Correction of anemia and stabilization of electrolyte balance
(c) Control of infection by antibiotics as determined by urine culture and sensitivity tests
(d) If operation is imperative, follow procedure for nephrectomy under hydronephrosis (p 252)

2 Multicystic disease
Preparation for nephrectomy as under hydronephrosis (p 252)

3 Solitary cystic disease
Preparation for excision of cyst does not vary from nephrectomy See under hydronephrosis (p 252)

POSTOPERATIVE MANAGEMENT

1 *Orders* (for either nephrectomy or cyst puncture or excision) Follow nephrectomy management as under hydronephrosis (p 253) In addition in polycystic disease
(a) Extremely careful control of fluid and electrolyte balance
(b) Continue antimicrobials until there has been an afebrile course for 3-4 days

2 *Dressings* In cyst puncture remove drains in 5 10 days In solitary cyst removal drains removed third to fifth day

3 *Studies* Careful control of urinary infection fluid and electrolyte balance indefinitely

4 *Complications*
Increasing azotemia and electrolyte imbalance

CHRONIC PYELONEPHRITIS ATROPHIC PYELONEPHRITIS PYONEPHROSIS APLASIA; HYPOPLASIA

Pre and postoperative orders for surgical treatment are essentially those detailed for nephrectomy under hydronephrosis (pp 252 253) with addition of antimicrobial therapy as governed by urine bacteriologic studies

PERINEPHRITIC ABSCESS AND RENAL CARBUNCLE

REQUIRED STUDIES

1 History
(a) Toxemia unresponsive to antimicrobial therapy
(b) Staphylococcic type of skin lesion

(c) Malaise
(d) Pain, abdominal and flank, on breathing, walking, or motion of trunk
(e) Gastrointestinal disturbance

2 Physical examination
(a) Fever, unresponsive to antimicrobial therapy
(b) Pain and tenderness, costovertebral and abdominal
(c) Mass in flank
(d) Flexion toward involved side
(e) Spasm of back muscles

3 Laboratory studies
(a) Marked polymorphonuclear leukocytosis
(b) Anemia
(c) Urine culture may be positive
(d) Pyuria and hematuria may be present
(e) Nonprotein nitrogen

4 Urography, excretory and retrograde

ELECTIVE STUDIES

1 Studies necessary to rule out orthopedic, abdominal, respiratory, and neurologic disease
2 Blood culture

DIFFERENTIAL CONSIDERATIONS

1 Acute pyelonephritis
2 Influenza, pleurisy, pneumonia
3 Renal tumor or cyst
4 Spinal caries, hip or thigh disease
5 Appendicitis
6 Salpingitis

PREOPERATIVE TREATMENT AND ORDERS

1 Continuation of intensive antibiotic therapy
2 Correction of anemia by transfusion
3 Hydration, orally if not contraindicated by vomiting
4. Preanesthetic restriction of oral intake and medication by age and weight (see Chapter 3, p 35)

POSTOPERATIVE MANAGEMENT

1 *Orders.*
(a) Intensive antibiotic therapy as indicated by culture of pus evacuated

(b) Continuation of intensive hydration orally if possible, otherwise, by intravenous fluids (30-35 cc./lb /24 hrs.)
(c) Sedation codeine, or morphine as required by age and weight (see Chapter 4 p 58)
(d) Vitamin reinforced diet as soon as possible
(e) With incision and drainage and decortication keep patient on operated side to promote drainage

2 *Dressings*
(a) With incision and drainage and decortication dressings changed as frequently as every two to three hours to prevent saturation.
(b) Penrose drains removed seventh to ninth day or when drainage ceases Drains shortened every second or third day
(c) Silk sutures removed seventh to ninth day

3 *Studies*
(a) Urine cultures to check sterilization of urine.
(b) Excretory urographic follow up of function of remaining and/or contralateral kidney at 3 6 and 12 months and then yearly

4 *Complications*
(a) Involvement of contralateral kidney in acute suppurative process thrombosis and infarction
(b) If kidney not removed, affected side may develop recurrent involvement, pyonephrosis, atrophic pyelonephritis or upper ureteral obstruction

RENAL TUBERCULOSIS

REQUIRED STUDIES

1 History
(a) Dysuria, frequency and urgency
(b) Pain in kidney bladder or urethra.
(c) Loss of weight and strength
(d) Gastrointestinal disturbances

2 Physical examination
(a) Kidney may be enlarged.
(b) Low grade fever with afternoon elevation
(c) Sweating
(d) Search for tuberculous foci in lymph glands bowel and bones

(e) Examination of genitalia for tuberculous involvement

3 Laboratory examination
   (a) Sterile acid pyuria
   (b) Tuberculous bacilluria, stain centrifuged sediment of 12-24 hour specimen
   (c) Hematuria
   (d) Anemia and leukopenia
   (e) Nonprotein nitrogen
   (f) Chest film
   (g) Tuberculin test—not always positive

4 Excretory urogram

5 Cystoscopy and retrograde pyelogram
   (a) Ulceration, inflammation, edema, and tubercle formation in bladder "Golf hole" ureteral orifice
   (b) Ureteral catheterization for
      i) Differential renal function, phenolsulfonphthalein
      ii) Differential urine specimens for staining centrifuged sediment for tubercle bacilli, culture, and guinea pig inoculation
      iii) Pyelography for anatomic diagnosis

ELECTIVE STUDIES

None indicated

DIFFERENTIAL CONSIDERATION

Nontuberculous pyelonephritis and pyonephrosis

PREOPERATIVE TREATMENT AND ORDERS

1 Three to 4 months' therapy with streptomycin (25-1 0 Gm) intramuscularly by age and weight twice weekly, para aminosalicylic acid (0 1-0 2 Gm /kg) in divided doses daily by mouth, isoniazid (4 0-7 0 mg /kg) in divided doses daily by mouth

2 Rest

3 Nephrectomy in unilateral tuberculosis or heminephrectomy Follow procedure under hydronephrosis (p 252)

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Same as technic under nephrectomy and heminephrectomy (see hydronephrosis, p 253)

(b) Continue regimen of streptomycin P.A S and isoniazid for 1 1½ years
(c) Prolonged rest

2 *Dressings*
(a) Silk sutures removed eighth to ninth day
(b) No drains

3 *Studies* Follow up studies of remaining kidney by urography urine sediment stained and cultured for tubercle bacilli at 3 month intervals for 2 3 years then at increasing intervals to 1 year and thus for life

4 *Complications*
(a) Wound breakdown and fistulization (rare with present medical regimen)
(b) Activation of unrecognized or unhealed lesion in remaining kidney substance (intensify medical regimen)
(c) Persistence of vesical ulceration (fulguration of ulcerations search for focus in ureteral stump and genitalia intensify medical regimen local chlorpactin*)
(d) Intractable vesical contracture (cutaneous ureterostomy if cultures positive for tubercle bacilli if cultures negative, ureterosigmoidostomy)

KIDNEY CALCULUS DISEASE

REQUIRED STUDIES

1 History
(a) Pain in renal area or abdomen
(b) Gastrointestinal disturbances
(c) Abnormal urinary habits
(d) Anuria
(e) Commonly associated with kidney anomalies
(f) May be asymptomatic

2 Physical examination
(a) Costovertebral and flank tenderness
(b) Fever

3 Laboratory examination
(a) Persistent pyuria.
(b) Hematuria.
(c) Nonprotein nitrogen
(d) Ca, P serum protein uric acid
(e) Sulkowitch test for hypercalciuria.

(f) Urine culture with sensitivity tests
4 Excretory urogram
5. Cystoscopy and retrograde pyelogram
(a) Differential phenolsulfonphthalein
(b) Opaque contrast media and air pyelography

ELECTIVE STUDIES

1 Urinary calcium excretion estimation (24-hour)
2 X-ray skeletal survey for osteitis fibrosa cystica

DIFFERENTIAL CONSIDERATIONS

1 Hyperparathyroidism
2 Acute surgical disease of abdomen, especially appendicitis
3 Cholelithiasis
4 Calcified mesenteric lymph nodes
5 Artefact shadows, e g , enteric coated tablets, barium, foreign bodies, etc
6 Acute obstructive and/or infectious diseases of kidney

PREOPERATIVE TREATMENT AND ORDERS

1 Intensive antimicrobial therapy according to urine bacteriologic studies
2 Correction of anemia and electrolyte balance
3 Force fluids by mouth with supplemental intravenous fluids if necessary for good hydration
4 High caloric diet with supplemental vitamins
5 Type and cross-match blood for transfusion
6 Cut-down for intravenous fluids
7 Preanesthetic restriction of oral intake and medication by age and weight (see Chapter 3, p 35)

POSTOPERATIVE MANAGEMENT

1 *Orders*
(a) Continue antimicrobial therapy
(b) Replace blood loss according to accurate calculation from weighed sponges
(c) No fluids by mouth until peristalsis active Maintain high-level hydration and electrolyte balance by intravenous fluids (30 40 cc lb 24 hrs) with supplemental vitamins Intake and output chart
(d) Connect nephrostomy or pyelostomy catheter, if used

to closed sterile drainage system as shown in Figure 41 Irrigate as required to maintain unobstructed drainage with sterile N.S.S or solution M (Suby)

(e) Sedation codeine or morphine as required by age and weight (see Chapter 4 p 58)

(f) Salicylamide or acetylsalicylic acid by age and weight to prevent recurrence of calcium-containing stones.

(g) High fluid intake always to reduce concentration of urinary crystalloids

(h) Well balanced diet with high vitamin reinforcement except vitamin D

(i) Dietary regimens, as alkaline or acid ash estrogens and aluminum hydroxide gels contraindicated in infants and children due to nutritional demands and sexual maturation

(j) Early ambulation and postural drainage in bedridden children

2 *Dressings*

(a) Penrose drains removed fifth to seventh day

(b) Silk sutures removed fifth to seventh day

(c) Drainage catheter when utilized removed seventh to tenth day in pyeloureteroplasty 21 days

3 *Studies*

(a) Urographic follow up at 3 6 and 12 months and then yearly

(b) Urine follow up microscopic and bacteriologic, at same intervals

4 *Complications*

(a) Recurrence (elimination of obstruction, stasis and infection Remove calculus)

(b) Fistula (remove obstruction)

(c) Uremia (adjust hydration and electrolyte balance)

RUPTURE OF KIDNEY

(See Chapter 8 p 146)

RENAL EMBRYOMA

(Wilms s Tumor)

REQUIRED STUDIES

1 Physical finding of abdominal mass

2 X ray examination of lungs, skull and sample long bones

FIG 43—Adhesive sign placed on the abdomen to prevent palpation of Wilms's mass and spread of tumor

3 Excretory urogram (retrograde pyelogram if necessary)
4 Urinalysis

ELECTIVE STUDIES

1 Bone marrow aspiration
2 Renal function tests phenolsulfonphthalein, nonprotein nitrogen
3 Gastrointestinal series or barium enema if origin of mass still not clear-cut

DIFFERENTIAL CONSIDERATIONS

1 Neuroblastoma
2. Hydronephrosis
3 Horsesho
4 Retroperi r
5 Omental
6 Hepatc
7 Duplicat tinal tr
8 Renal cyst

PREOPERATIVE TREATMENT AND ORDERS

1 Hydration by oral intake.
2 Cut-down in vein and adequate hemoglobin replacement if necessary
3 No palpation of abdomen after initial physical examination Adhesive reminder attached to abdomen (Fig 43)

POSTOPERATIVE MANAGEMENT

1 *Orders*
  (a) Nothing by mouth until peristalsis returns or flatus passes
  (b) Intravenous fluids
  (c) Wangensteen drainage with irrigation every 2 hours with N S.S
  (d) Antibiotics continued until temperature normal
  (e) Measure and record intake and output carefully
  (f) X ray therapy started day following surgery If preceded by nitrogen mustard therapy delay until hemogram is normal
2 *Studies*
  (a) Chest film every 3 months for 2 years postoperatively and then yearly
  (b) Bone survey every 6 months for 1 year postoperatively and then yearly
3 *Complications* Rare

URETER

STRICTURE

REQUIRED STUDIES

1 History
  (a) Lumbar and abdominal pain, backache
  (b) Urinary frequency urgency and tenesmus
  (c) Gastrointestinal disturbances
2 Physical examination
  (a) Lumbar and abdominal tenderness
  (b) Occasionally dilated ureter and kidney palpable.
3 Laboratory examination

4. Excretory urogram
5 Cystography massive ureteral reflux
6 Cystoscopy
   (a) No infravesical or vesical neck obstruction in megaloureter
   (b) Patulous ureteral orifices may be present in both.
   (c) No ureteral obstruction on catheterization in megalo ureter, obstruction present in hydroureter

ELECTIVE STUDIES

1 Cystometry to determine neurogenic involvement of bladder
2 Ureterometry.

DIFFERENTIAL CONSIDERATION

Chronic pyelonephritis

PRE AND POSTOPERATIVE MANAGEMENT

With megaloureter, in the absence of ureteral stasis, the treatment is elimination of infection and bladder training If there is stasis due to obstruction from ureteral redundancy, ureteroneo cystostomy or a pull-through procedure is indicated Results in megaloureter are disappointing In hydroureter, operative removal of obstruction is indicated See ureteral stricture for detailed management (p 268)

URETEROCELE

REQUIRED STUDIES

1 History
   (a) Pain, flank or back
   (b) Urinary frequency, urgency, dysuria, retention
2 Physical examination
   (a) Tenderness, lumbar
   (b) Ureterocele may prolapse through urethra in female
3 Laboratory examination
   (a) Persistent pyuria
   (b) Urine culture with sensitivity tests
   (c) Nonprotein nitrogen phenolsulfonphthalein
4 Excretory urogram
5 Cystoscopy

ELECTIVE STUDIES

1 Cystography
2 Chromocystoscopy
3 Retrograde pyelography
4 Search for coexisting anomalies

DIFFERENTIAL CONSIDFRATIONS

1 Ureteral stricture
2 Urethral prolapse
3 Urethral eversion

PREOPERATIVE TREATMENT AND ORDERS

1 If upper tract is not markedly obstructed above the uretero cele and gives promise of functional rehabilitation supra pubic excision of the ureterocele is indicated The pre operative management is detailed above under stricture of ureter and ureteroneocystostomy (p 268)
2 In case of minimal upper tract drainage and a small uretero cele transurethral electrosurgical division or excision of ureterocele may be done Preoperative orders then are con fined to indicated antimicrobials and preanesthetic orders

POSTOPERATIVE MANAGEMENT

1 For suprapubic resection of ureterocele see detailed man agement under Ureteral Stricture (p 268)
2 Transurethral electrosurgical resection
(a) Orders
i) Fluids by mouth as soon as tolerated
ii) Intake and output
iii) Mild sedation if necessary
iv) Antimicrobials continued until urine normal cul turally and microscopically
v) Ambulation following day

ECTOPIA

REQUIRED STUDIES

1 History
Disturbance of urinary habits— wetting at any time

2 Physical examination
   Observation of ectopic ureteral orifice
3 Laboratory examination
   (a) Pyuria
   (b) Urine culture with sensitivity tests
   (c) Nonprotein nitrogen, differential phenolsulfonphthalein
4 Identification by external, vaginal, or cystoscopic observation of ectopic ureteral orifice
5 Urography, excretory and retrograde

ELECTIVE STUDIES

Chromoscopy (indigo carmine)

DIFFERENTIAL CONSIDERATIONS

1 Other causes of urinary infection
2 True vesical incontinence
3 Urinary fistula

PREOPERATIVE TREATMENT AND ORDERS

1 If the kidney is seriously damaged due to infection and obstruction, ureteronephrectomy or ureteroheminephrectomy is indicated and the procedure in these cases is that detailed under "Hydronephrosis" (p 251)
2 If the ectopic ureter is the only one on that side and leads to a sound kidney, ureteroneocystostomy is indicated See Ureteral Stricture for details (p 267)

POSTOPERATIVE MANAGEMENT

1 See "Hydronephrosis" (p 251) for management in case of ureteronephrectomy or ureteroheminephrectomy
2 Ureteroneocystostomy See "Stricture" under "Ureter" (p 267)

BLADDER

EXSTROPHY

REQUIRED STUDIES

1 Diagnosis made by inspection

3 Blood chemistries nonprotein nitrogen K, Na, Cl CO_2 combining power

ELECTIVE STUDIES

Search for coexisting anomalies

DIFFERENTIAL CONSIDERATIONS

None

PREOPERATIVE TREATMENT AND ORDERS

When preliminary colostomy has not been done and either ureterosigmoidostomy or vesicoproctostomy (Boyce Vest operation) is to be done

1 Correction of electrolyte imbalance and anemia if present
2. Low residue high protein, multivitamin reinforced diet mostly liquids starting 4 days preoperatively
3 Diet restricted to glucose and water the last preoperative day
4 High fluid intake
5 Nightly laxative of mineral oil and milk of magnesia by age and weight, except for last preoperative night
6 Twice daily saline enemas The day before operation and the morning of operation the enemas are to be given until return is clear
7 Paregoric by age and weight three times a day the last preoperative day
8 For 4 preoperative days syrup of strycin® sulfate (20 mg /lb /24 hrs) and sulfasuxidine® (250 mg /K/24 hrs) for bowel sterilization
9 If more rapid sterilization is desired terramycin® (0 4-2 0 Gm.) and neomycin (0 5 2 0 Gm) by age and weight daily for 48 hours may be used.
10 A 4-eye #24F Robinson catheter is anchored in the rectum to deflate bowel of gas and fluid the morning of operation
11 Preanesthetic restriction of oral intake for 4 hours and medication by age and weight (see Chapter 3 p 35)

If a preliminary colostomy has been done

1 Correction of electrolyte balance and anemia if present
2 High protein and multivitamin diet, but not low residue
3 High fluid intake.

4 Cleansing saline enemas of the blind rectal and colonic pouch twice daily for 3 days preoperative and morning of operation
5 Following cleansing enema as above, instill solution of topical neomycin into blind pouch
6 A 4-eye #24F Robinson catheter is anchored in rectum following enema morning of operation
7 Preanesthetic restriction of oral intake for 4 hours and medication by age and weight (see Chapter 3, p 35)

POSTOPERATIVE MANAGEMENT AND ORDERS

1 *Orders.*
   (a) Firmly anchored indwelling open end rectal catheter #22-24F with at least 2 additional fenestra is irrigated gently with saline solution every 1-2 hours to maintain unobstructed drainage
   (b) Accurate intake and output charted
   (c) Nothing by mouth until peristalsis well established
   (d) Intravenous fluids (35-40 cc /lb./24 hrs), with supplemental vitamins, by slow drip
   (e) Whole blood transfusion
   (f) Prophylactic antibiotics, as penicillin fortified 400,000 800,000 U and streptomycin (0 5-1 0 Gm) intramuscularly daily for 7-10 days
   (g) Sedation, phenobarbital or codeine by age and weight, as required (see Chapter 4, pp. 57-58).
   (h) Formula and/or regular diet (fortified with supplemental vitamins) resumed as soon as tolerated, usually third to fourth day
   (i) Ambulatory day of removal of rectal catheter
2 *Dressings*
   (a) Silk sutures removed fifth to seventh day, except in Boyce-Vest vesicoproctostomy, and reconstruction of epispadias when sutures removed eighth to tenth day
   (b) Penrose drains removed fifth to seventh day
   (c) Rectal catheter removed eighth to twelfth day
3 *Studies*
   (a) Careful follow up of electrolyte balance and correction if necessary

(b) Status of upper urinary tract checked before discharge and at 3-6 month intervals by excretory urography

4 *Complications*

(a) Gastric and intestinal distention (gastric intubation and suction Re-establishment of parenteral fluids)

(b) Urinary and/or fecal drainage from leaking anastomosis and localized peritonitis (reinsertion of rectal catheter with irrigations for unobstructed drainage Continuation of antibiotics This usually will suffice)

(c) Acute pyelonephritis (antibiotics and establishment of free rectal drainage)

(d) Chronic recurrent pyelonephritis with increasing upper tract dilatation (colostomy if not previously established If this is not corrective reanastomosis)

(e) Stenosis of anastomotic site (reanastomosis In Boyce Vest procedure manual dilatation of vesicoproctostomy)

(f) Hyperchloremic acidosis and azotemia (control of infection forced fluids sodium or potassium citrate by mouth frequent rectal voiding [every 2 hours])

(g) Wound dehiscence (immediate resuture)

CONTRACTURE OF BLADDER NECK

REQUIRED STUDIES

1 History

(a) Acute or chronic urinary retention

(b) Urgency frequency difficulty and hesitancy of urination

(c) Small caliber of urinary stream

(d) Pain on urination, in suprapubic or renal region

(e) Intermittent urinary stream

(f) Overflow incontinence

2 Physical examination

(a) Palpable bladder

(b) Residual urine

3 Laboratory examination

(a) Pyuria

(b) Hematuria.

(c) Nonprotein nitrogen phenolsulfonphthalein

(d) Urine culture with sensitivity tests.

4 Panendoscopy

5 Urography, excretory and retrograde

ELECTIVE STUDIES

1 Cystometry to determine neurogenic muscular imbalance of bladder

2 Cystography shows presence of ureteral reflux and absence of ureterovesical stricture

DIFFERENTIAL CONSIDERATIONS

1 Posterior urethral valves

2 Hypertrophy of the verumontanum

3 Urethral stricture

4 Neuromuscular disease

PREOPERATIVE TREATMENT AND ORDERS

See Diverticula of Bladder, p 277

POSTOPERATIVE MANAGEMENT AND ORDERS

1 Catheter removed in 24-72 hours

2 Otherwise see Diverticula of Bladder, p 277

DIVERTICULA OF BLADDER

REQUIRED STUDIES

1 History

(a) "Installment" urination

(b) Urinary frequency and dysuria

2 Physical examination

Occasional suprapubic mass

3 Laboratory examination

(a) Pyuria, often foul and debris laden, particularly on repeat urination

(b) Hematuria

(c) Urine culture with sensitivity tests

(d) Nonprotein nitrogen

4 Cystoscopy

5. Cystography
6. Excretory urography

ELECTIVE STUDIES

None indicated

DIFFERENTIAL CONSIDERATIONS

1. Urachal cyst
2. Duplex bladder

PREOPERATIVE TREATMENT AND ORDERS

1. Intensive antimicrobial treatment of urinary infection
2. Bladder decompression and thus relief of upper tract obstruction if present
3. Forced fluids intake and output chart
4. Correction of anemia and electrolyte imbalance if present
5. Preanesthetic restriction of oral intake for 3-4 hours and sedation by age and weight (see Chapter 3 p 35)

POSTOPERATIVE MANAGEMENT

1. *Orders*
   (a) Fluids and diet as tolerated
   (b) Replacement of operative blood loss as accurately calculated
   (c) Intravenous fluids with supplemental vitamins (30-35 cc./lb /24 hrs)
   (d) Connect drainage catheter to closed sterile drainage system (Fig 41)
   (e) Intensive antimicrobial therapy as indicated by bacteriologic studies
   (f) Sedation, phenobarbital or codeine by age and weight as required (see Chapter 4 pp 57 58)
   (g) Ambulatory after drainage catheter removed
2. *Dressings*
   (a) Silk sutures removed fifth to seventh day
   (b) Penrose drains removed third to fifth day
   (c) Drainage catheter removed seventh to ninth day
3. *Studies*
   (a) Excretory urographic follow up study of upper urinary tract.

(b) Urine culture follow-up to be sure urine remains sterilized after antimicrobials are discontinued

RUPTURE OF BLADDER AND/OR URETHRA

REQUIRED STUDIES

1. History
   (a) Trauma
   (b) Difficulty or inability to urinate
   (c) Shock
   (d) Nausea and vomiting
   (e) Pain—abdominal with bladder, perineal with urethral rupture
2. Physical examination
   (a) Tenderness and rigidity of abdomen with bladder rupture
   (b) Tenderness and swelling of perineum with urethral rupture
   (c) Urinary extravasation, ecchymosis
   (d) Fever
   (e) Hypotension
3. Laboratory examination
   (a) Hematuria, or bleeding from urethra
   (b) Anemia and leukocytosis
   (c) Nonprotein nitrogen
4. Urethrocystography.
5. Panendoscopy (urethra), cystoscopy (bladder)
6. Excretory urography in bladder rupture
7. Gentle urethral catheterization in urethral rupture

ELECTIVE STUDIES

None

DIFFERENTIAL CONSIDERATIONS

Bladder or urethral contusion

PREOPERATIVE TREATMENT AND ORDERS

1. Combat shock by blood transfusion for hemorrhage and anemia intravenous fluids (30 40 cc lb /24 hrs) for hydration heat, sedation morphine by age and weight (see Chapter 3 p 58)

2 Nothing by mouth until operative status determined, especially in bladder rupture
3 Antibiotic therapy penicillin and streptomycin by age and weight
4 Blood pressure and pulse charted every hour
5 Preoperative medication by age and weight in consultation with anesthetist (Chapter 3 p 35)

POSTOPERATIVE MANAGEMENT

1 *Orders*
 (a) Blood replacement by transfusion according to estimated loss and blood count
 (b) Intravenous fluids (30-40 cc lb /24 hrs) to maintain hydration until oral fluid intake is adequate
 (c) Blood pressure and pulse every half hour until stabilized and then every 3 hours
 (d) Accurate intake and output chart
 (e) Blood count every 12 hours for 48 hours then every second day
 (f) Attach large cystostomy tube perineal or urethral catheter to continuous closed sterile drainage system (Fig 41) Irrigate with sterile saline solution only as required to maintain patency
 (g) Sedation, morphine by age and weight as required (see Chapter 4 p 58)
 (h) Continue antibiotics
 (i) General diet when tolerated
 (j) If pelvic fracture coexists, use pelvic sling with legs extended Orthopedic consultation
 (k) Ambulatory seventh to tenth day or when orthopedic complications allow
2 *Dressings*
 (a) Penrose drains removed fifth to tenth day
 (b) Silk sutures removed fifth to seventh day
 (c) Suprapubic cystostomy catheter removed seventh to tenth day urethral catheter tenth to fourteenth day
3 *Studies*
 (a) Orthopedic status
 (b) Urethral calibration and cystoscopy

   (c) Excretory urography to determine status of upper urinary tract
   (d) Bacteriologic study of urine

4 *Complications*
   (a) Fistula (prevent or correct obstruction from stricture)
   (b) Hemorrhage (suture ligature, transfusion)
   (c) Infection (antimicrobials and drainage)
   (d) Stricture of bladder neck or urethra (dilatation or operative correction)

URETHRA

STRICTURE

REQUIRED STUDIES

1 History
   (a) Meatitis
   (b) Urinary urgency, frequency, difficulty, dribbling, and tenesmus

2 Physical examination
   (a) Commonest variety, stricture of external meatus, diagnosed by inspection
   (b) Deeper strictures located by calibration with sounds and bulbous bougies
   (c) Mucopurulent urethral discharge

3 Laboratory examination
   (a) Hematuria
   (b) Pyuria

ELECTIVE STUDIES

1 Urethrocystography
2 Urine culture and sensitivity tests if pyuria is present
3 Excretory urography and renal function tests if signs of upper tract damage are present

DIFFERENTIAL CONSIDERATIONS

Lower tract obstructive uropathy from other or coexisting causes

PREOPERATIVE TREATMENT AND ORDERS

If anesthesia is to be used for meatotomy or urethral dilatation, routine preanesthetic restriction of oral intake and medication by age and weight (see Chapter 3, p 35)

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Meatotomy wound manually dilated by parent twice daily to three times daily
   (b) Ointment such as polysporin® or A&D applied to meatotomy wound following manual dilatation to lessen scabbing
   (c) Dilatation with sounds 1 2 and 4 weeks postoperatively as required
2 *Dressings and Studies*
   None.
3 *Complication*
   Recurrence of stricture (if it does not respond to dilatation, reoperate)

HYPOSPADIAS

REQUIRED STUDIES

Diagnosis by observation

ELECTIVE STUDIES

1 Urethral calibration and urethroscopy
2 Androgen and estrogen studies and abdominal exploration if necessary for differential sexual diagnosis

DIFFERENTIAL CONSIDERATIONS

1 Pseudohermaphroditism or intersex variants
2 Adrenal virilism

PREOPERATIVE TREATMENT AND ORDERS

Multistaged procedure with correction of chordee before 2 years of age and urethral reconstruction 3 5 years of age
1 Correction of anemia and hypoproteinemia if present
2 Preanesthetic restriction of oral intake for 3 4 hours and medication by age and weight (see Chapter 3 p 35)

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Perineal urethrostomy or urethral catheter attached for continuous drainage to closed sterile drainage system

(Fig 41) Catheter irrigations with half-strength Suby solution G daily and as required to maintain catheter patency and prevent calcareous deposit on catheter

(b) Antibiotic therapy, penicillin fortified and streptomycin by age and weight for 7-9 days

(c) Intravenous fluids (20-30 cc /lb /24 hrs) if necessary to maintain hydration, otherwise fluids and diet orally as tolerated

(d) Adequate vitamin intake

(e) Sedation with phenobarbital or codeine as required by age and weight (see Chapter 4, pp 57-58)

(f) Salicylamide or acetylsalicylic acid by age and weight to prevent calcareous catheter deposit

(g) Ambulatory seventh day

2 *Dressings.*

(a) Telfa pressure dressing removed fifth day, earlier if fever present or severe soiling of dressing

(b) Perineal urethrostomy catheter out seventh day

(c) Silk sutures removed ninth day

(d) Wire stay sutures removed twelfth to fourteenth day

3 *Studies:*

Urethral dilatation to assure adequate caliber urethral canal

4 *Complications*

(a) Wound breakdown or suture line separation (prevented by primary diversion of urinary stream, gentle tissue handling, prevention of skin tension, control of infection by antibiotics, and prevention of penile erection)

(b) Fistula (delayed closure with primary urine diversion by perineal urethrostomy)

EPISPADIAS

REQUIRED STUDIES

Diagnosis by observation and presence of incontinence

ELECTIVE STUDIES

Cystoscopy

DIFFERENTIAL CONSIDERATIONS

None

PREOPERATIVE TREATMENT AND ORDERS

Multistaged procedure with correction of chordee at 1 year of age and urethroplastic repair of epispadias and correction of incontinence at 3 years of age when vesical continence should be established normally

1 Correction of anemia and hypoproteinemia if present.
2 Preanesthetic restriction of oral intake for 3-4 hours and medication by age and weight (see Chapter 3 p 35)

POSTOPERATIVE MANAGEMENT

1 *Orders* See Hypospadias (p 281) Suprapubic cystostomy used to divert urinary stream
2 *Dressings*
   (a) Telfa pressure dressing removed fifth day
   (b) Silk sutures removed ninth day
   (c) Nonabsorbable urethral suture guide in incontinence correction removed fourteenth day
   (d) Suprapubic catheter removed twenty first day
3 *Studies*
   (a) Following removal of suprapubic catheter urethra is calibrated to determine patency which should be #6-8F in size
   (b) Exercises—start stop type—to regain normal control should be carried out for necessary time (3 months to 2 years)
4 *Complications*
   (a) Urethral fistula (closure of fistula after primary supra pubic urinary diversion)
   (b) Continued incontinence (should not be considered a failure under 2 years After this may be reoperated)

POSTERIOR URETHRAL VALVES

REQUIRED STUDIES

1 History
   (a) Symptoms frequently severe in neonatal period
   (b) Urinary frequency hesitancy difficulty
   (c) Overflow incontinence
   (d) Pain on urination, in suprapubic or renal area

(Fig 41) Catheter irrigations with half-strength Suby solution G daily and as required to maintain catheter patency and prevent calcareous deposit on catheter

(b) Antibiotic therapy, penicillin fortified and streptomycin by age and weight for 7-9 days

(c) Intravenous fluids (20-30 cc /lb /24 hrs) if necessary to maintain hydration, otherwise fluids and diet orally as tolerated

(d) Adequate vitamin intake

(e) Sedation with phenobarbital or codeine as required by age and weight (see Chapter 4, pp 57-58)

(f) Salicylamide or acetylsalicylic acid by age and weight to prevent calcareous catheter deposit

(g) Ambulatory seventh day

2 *Dressings*

(a) Telfa pressure dressing removed fifth day, earlier if fever present or severe soiling of dressing

(b) Perineal urethrostomy catheter out seventh day

(c) Silk sutures removed ninth day

(d) Wire stay sutures removed twelfth to fourteenth day

3 *Studies*

Urethral dilatation to assure adequate caliber urethral canal

4 *Complications*

(a) Wound breakdown or suture line separation (prevented by primary diversion of urinary stream, gentle tissue handling, prevention of skin tension, control of infection by antibiotics, and prevention of penile erection)

(b) Fistula (delayed closure with primary urine diversion by perineal urethrostomy)

EPISPADIAS

REQUIRED STUDIES

Diagnosis by observation and presence of incontinence

ELECTIVE STUDIES

Cystoscopy

DIFFERENTIAL CONSIDERATIONS

None

PREOPERATIVE TREATMENT AND ORDERS

Multistaged procedure with correction of chordee at 1 year of age and urethroplastic repair of epispadias and correction of incontinence at 3 years of age when vesical continence should be established normally

1 Correction of anemia and hypoproteinemia if present
2 Preanesthetic restriction of oral intake for 3-4 hours and medication by age and weight (see Chapter 3 p 35)

POSTOPERATIVE MANAGEMENT

1 *Orders* See Hypospadias (p 281) Suprapubic cystostomy used to divert urinary stream
2 *Dressings*
   (a) Telfa pressure dressing removed fifth day
   (b) Silk sutures removed ninth day
   (c) Nonabsorbable urethral suture guide in incontinence correction removed fourteenth day
   (d) Suprapubic catheter removed twenty first day
3 *Studies*
   (a) Following removal of suprapubic catheter urethra is calibrated to determine patency which should be #6-8F in size
   (b) Exercises—start stop type—to regain normal control should be carried out for necessary time (3 months to 2 years)
4 *Complications*
   (a) Urethral fistula (closure of fistula after primary suprapubic urinary diversion)
   (b) Continued incontinence (should not be considered a failure under 2 years After this, may be reoperated)

POSTERIOR URETHRAL VALVES

REQUIRED STUDIES

1 History
   (a) Symptoms frequently severe in neonatal period
   (b) Urinary frequency hesitancy difficulty
   (c) Overflow incontinence
   (d) Pain on urination in suprapubic or renal area.

(e) Failure to develop or gain weight
(f) Gastrointestinal disturbances.

2 Physical examination
(a) Pyuria
(b) Chronically distended bladder may be palpable
(c) Kidneys may be palpable

3 Laboratory examination
(a) Pyuria
(b) Blood chemistries nonprotein nitrogen, phenolsulfonphthalein, Na, Cl, and CO_2 combining power
(c) Urine culture with sensitivity tests

4. Panendoscopy.
5 Excretory urography

ELECTIVE STUDIES

Retrograde urethrocystography

DIFFERENTIAL CONSIDERATIONS

1 Urethral mucosal redundancy
2 Stricture of urethra
3 Contracture bladder neck
4 Hypertrophy verumontanum
5 Spastic neuromuscular disease
6 Enuresis
7 Abdominal tumor
8 Acute and chronic pyelonephritis
9 Nephritis
10 Polycystic kidney disease

PREOPERATIVE TREATMENT AND ORDERS

1 Urethral or suprapubic catheter drainage until reasonable electrolyte balance and control of infection is obtained
2 If upper tract is markedly obstructed due to ureteral redundancy, preliminary nephrostomy may be necessary
3 Correction of anemia if present
4 Antimicrobial therapy depending on urine bacteriologic studies
5 Force fluids for adequate hydration, followed by accurate intake and output chart

6. Preanesthetic restriction of oral intake for 3-4 hours and medication by age and weight (see Chapter 3 p 35)

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Urethral catheter connected to closed sterile drainage bottle (Fig 41)
   (b) Antimicrobial therapy continued intensively
   (c) Close control of electrolyte balance maintained
   (d) Intravenous fluids (30 35 cc / lb /24 hrs) until adequate hydration can be maintained by resumption of normal diet and fluid intake by mouth Accurate intake and output chart
   (e) Mild sedation with phenobarbital or codeine as required by age and weight (see Chapter 4 pp 57 58)
   (f) Ambulatory third day
2 *Dressings*
   (a) If transurethral operation catheter removed in 3 days
   (b) If retropubic operation catheter removed in 5 7 days
   (c) Retropubic incisional silk sutures removed fifth to seventh day
3 *Studies*
   (a) Careful follow up of urine by culture until sterility is assured after discontinuance of antimicrobials
   (b) Excretory urographic follow up of status of upper urinary tract If obstruction is present in ureters, ureteroplasty indicated
4 *Complications*
   Incomplete removal of valves (reoperate)

GENITALIA

PHIMOSIS REDUNDANT PREPUCE

REQUIRED STUDIES

Diagnosis by inspection

PREOPERATIVE TREATMENT AND ORDERS

1 In neonatal period bleeding and coagulation time
2 Preanesthetic restriction of oral intake for 3-4 hours, and

medication by age and weight if anesthetic to be used (see Chapter 3, p 35)

POSTOPERATIVE MANAGEMENT

1 *Orders*·
  (a) Sedation if necessary by age and weight
  (b) Diet as tolerated
2 *Complications*
  (a) Hematoma (compression dressing and ice bag If to no avail, reopen suture line and ligate offending vessel)
  (b) Inadequate removal of prepuce with or without cicatricial contracture and chordee (recircumcise, correct chordee)

TORSION OF SPERMATIC CORD

REQUIRED STUDIES

1 History
  (a) Abnormally mobile or improperly descended testicle
  (b) Sudden onset, may be chronic and recurrent, associated with milder symptoms
  (c) Pain, acute—in testicle or lower abdomen
  (d) Shock
  (e) Nausea and vomiting
2 Physical examination
  (a) Swelling, edema, and inflammation of scrotum
  (b) Shortening of cord which is edematous
  (c) Elevation of testicle increases pain
  (d) Lack of differentiation between testis and epididymis
3 Laboratory examination
  Leukocytosis

ELECTIVE STUDIES

None

DIFFERENTIAL CONSIDERATIONS

1 Strangulated hernia
2 Epididymo-orchitis

PREOPERATIVE TREATMENT AND ORDERS

Preanesthetic restriction of oral intake for 3-4 hours and medication by age and weight (see Chapter 3, p 35)

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Antibiotics
   (b) Sedation codeine or morphine by age and weight (see Chapter 1 p 58)
   (c) If orchiectomy not done warm compresses to scrotum with elevation
2 *Dressings* Sutures removed fifth to seventh day
3 *Studies* If possible late studies for spermatogenic function
4 *Complication* Contralateral torsion (fixation of opposite testicle at same operation)

HYDROCELE

See Chapter 8 (under Hernia)

IMPROPERLY DESCENDED TESTICLE (CRYPTORCHIDISM)

See Chapter 8

FUSION OF LABIA MINORA

See Chapter 8

ATRESIA OF HYMEN (HYDROMETROCOLPOS HEMATOCOLPOS)

See Chapter 8

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CHAPTER 14

Otorhinolaryngologic

HENRY K SHERMAN

SECRETORY OTITIS MEDIA

(MYRINGOTOMY WITH ASPIRATION)

REQUIRED STUDIES

1 E N T history and physical examination to determine etiology and treatment
  (a) Allergic work-up
  (b) Infection of upper respiratory tract
  (c) Disturbed physiology of nose
    i) Lymphoid hyperplasia of nasopharynx
    ii) Nasal deformities—septal irregularities
    iii) Cleft palate
2 Pneumatic otoscopy—Fixed drum indicates fluid
3 Hearing tests—conductive loss
  (a) Tuning forks
  (b) Audiogram

ELECTIVE S IDIES

1 Infla [illegible] le ear (if no [illegible] is present)—for
  tuba [illegible] diagnosis of [illegible] treatm
  (a) [illegible] —preferre

DIFFERENTIAL CONSIDERATIONS

1 Myringitis
2 Acute suppurative otitis media
3 External otitis
4 Herpes zoster oticus
5 Otosclerosis
6 Adhesive otitis media

PREOPERATIVE TREATMENT AND ORDERS

1 Nothing by mouth 4 hours prior to anesthesia
2 Preoperative medication (see Chapter 3 p 35)

POSTOPERATIVE MANAGEMENT

1 Treat etiology
2 Orders—normal living and eating as soon as tolerated
3 Aspirin—if pain (see Chapter 4 p 58)
4 No drops or manipulation in canal for 24 hours to avoid infection if ear discharges as in acute suppurative otitis media, treat similarly
5 Use of vasoconstrictors in nose is of little value

ACUTE SUPPURATIVE OTITIS MEDIA

(MYRINGOTOMY)

Myringotomy should be performed in all instances of acute nondraining otitis media and in cases where drainage is not adequate

REQUIRED STUDIES

1 History and physical examination to determine etiology and treatment as listed under secretory otitis media (p 288)
2 X ray mastoids if history and examination indicate
3 Clean canal and drum so study can be made and drum evaluated for diagnosis

ELECTIVE STUDIES

Culture nose and throat and ear sensitivity tests

DIFFERENTIAL CONSIDERATIONS

1 Otitis externa
2 Myringitis
3 Herpes zoster otitis
4 Secretory otitis media
5. Acute exacerbation of chronic otitis media

PREOPERATIVE TREATMENT AND ORDERS
(Most affected ears are opened quickly and without anesthesia)

1 Start treatment of etiology as indicated
2 Antibiotics
3 Nothing by mouth prior to anesthesia
4 Preoperative medication (see Chapter 3, p 35)

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Antibiotic drops in canal keep canal clean and prevent otitis externa
   (b) Continue or start treatment of etiology and continue systemic antibiotic
   (c) Cotton ear plug may be used as required
   (d) Use of vasoconstrictors in nose is of little value
2 *Complications*
   (a) Continued or recurrent drainage for 2 to 3 weeks suggests
      i) Mastoiditis
      ii) Persistent etiology

ACUTE MASTOIDITIS

(MASTOIDECTOMY)

REQUIRED STUDIES

1 History
   (a) How long has ear infection or symptomatology been present? In most cases bone necrosis takes 2 to 3 weeks
   (b) Recurrent attacks of otitis media may be due to mastoiditis
2 Examination (antibiotics may mask signs)

(a) Mastoid tenderness
(b) Edema, periosteal inflammation or abscess—superior canal wall or postauricular area
(c) Drum—picture of acute otitis media
(d) Purulent pulsating profuse discharge usual sign with mastoiditis
(e) Conductive deafness
(f) Fever

3 X ray mastoids
4 Complete blood count and differential
5 Culture and sensitivity tests

ELECTIVE STUDY

Spinal tap—when signs of meningeal irritation present

DIFFERENTIAL CONSIDERATIONS

1 Acute otitis externa
2 Acute suppurative otitis media
3 Acute exacerbation of chronic otitis media and mastoiditis

INDICATIONS FOR SURGERY
(Medical therapy is treatment of choice)

1 Failure of *medical treatment* after 10 days or so
2 Onset of complication e g meningitis, brain abscess lateral sinus thrombosis facial paralysis
3 Recurrent infection once cleared medically
4 X ray evidence of bone necrosis

PREOPERATIVE TREATMENT AND ORDERS

1 Antibiotics as indicated by sensitivity test
2 Intravenous fluids if indicated
3 *Orders*
(a) Shave hair ¾" above and around auricle.
(b) Nothing by mouth 4 hours preoperatively
(c) Preoperative medication desired for age and weight (see Chapter 3 p 35)

POSTOPERATIVE MANAGEMENT

1 *Orders*
(a) Diet as tolerated

FIG 44 —Mastoid dressing

(b) Aspirin and codeine for pain (see Chapter 4, p 58)
(c) Sedative (see Chapter 4, p 57)
(d) Antibiotics, local and systemic Local antibiotic keeps canal and drum clean
(e) Intravenous fluids if indicated
(f) Gradual return to normal activity starts first day

2 *Mastoid dressing* Dressing removed fourth day Changed daily in order to examine ear Clean canal and use local antibiotic Sutures out on fifth day Canal clean No need for open packing or irrigation of cavity with use of antibiotics

3 *Studies* None unless complications suspected

4 *Complications*

(a) Facial paralysis (reopen and expose nerve in canal if reason unknown)

(b) Meningitis—unlikely—(may have to reopen and explore if symptoms are persistent)

CHRONIC SUPPURATIVE OTITIS MEDIA WITH MASTOIDITIS

(MASTOIDECTOMY)

REQUIRED STUDIES

1 History
 (a) Onset of original infection
 (b) Duration of infection
 (c) Type and character of drainage
 (d) Signs of complications—vertigo facial weakness headache or pain
 (e) How well does patient hear?
2 Examination
 (a) Evaluate type of infection—i e cholesteatoma or osteomyelitic granulation type
  i) Odor important for cholesteatoma
 (b) Check for complications
  i) Record function of facial nerve
  ii) Fistula test—labyrinthine involvement—caloric testing
  iii) Meningeal irritation
  iv) Brain abscess
  v) Septicemia—lateral sinus thrombosis
3 Audiometric examination—complete with speech testing
4 X ray mastoids
5 Bacterial study of infection and sensitivity tests for antibiotic of choice

ELECTIVE STUDIES

1 Spinal tap when indicated
2 Blood culture when indicated—lateral sinus thrombosis

DIFFERENTIAL CONSIDERATIONS

1 There is no differential diagnosis aside from that made in evaluating complications
 (a) Facial paralysis—history important Other causes may be

i) Central
ii) Traumatic facial injuries or skull fracture
iii) Bell's palsy
iv) Birth injury
v) Parotid disease or tumor
vi) Geniculate ganglionitis

(b) Lateral sinus thrombosis—picture of septicemia
(c) Labyrinthitis—circumscribed serous or suppurative—vertigo—labyrinthine type
(d) Meningitis or meningismus
(e) Brain abscess, subdural or epidural hematoma

INDICATIONS FOR SURGERY

1. Complication (see above)
2. Persistent or recurrent acute attacks
3. Failure of local therapy

PREOPERATIVE TREATMENT AND ORDERS

1. *Orders* (general anesthesia used on children)
   (a) Prepare ear and shave hair ¾" above auricle
   (b) Nothing by mouth
   (c) Antibiotic systemically
   (d) Preoperative medication for age and weight (see Chapter 3, p 35)
   (e) Enema night before if avertin® basal anesthesia used
   (f) Intravenous fluids for surgery

POSTOPERATIVE MANAGEMENT

1. *Orders*.
   (a) Continue antibiotic chosen
   (b) Local antibiotic otic solution applied to packing three times first day Outer dressing may be omitted after 24 hours
   (c) Diet as tolerated
   (d) Aspirin and codeine for pain (see Chapter 4, p 58)
   (e) Sedation as required and at night (see Chapter 4, p 57)
   (f) May be up first day and gradually return to normal activity
2. *Dressings*
   (a) Packing and sutures out on fourth day Skin graft gauze not disturbed for 7 days

(b) Graft site dressed third day and every other day thereafter Sterile dressing technic and antibiotic ointment dressing

3 *Complications*

(a) Facial paralysis (if unexplained postoperatively reopen and explore uncovering nerve and grafting if necessary)

(b) Cellulitis of canal and skin—not likely with use of local and systemic antibiotics

(c) Vertigo—not common subsides spontaneously

(d) Labyrinthitis

(e) Meningitis—change antibiotics and add sulfadiazine intravenously

(f) Lateral sinus thrombosis and septicemia—blood culture change antibiotics

LATE POSTOPERATIVE CARE OF CAVITY

Extremely important until entire area is healed and epithelized

1 Antibiotics used locally (by patient three times a day)

(a) Chloromycetin* otic

(b) Neo Cortef‡ preparation—reduces granulation

(c) Antibiotic ointments for instillation in canals and auricles

2 Dry clean cavity and remove excess granulation twice weekly as required

3 Ears cleaned with 70% alcohol by patient as required and ointment applied

4 Sterile cotton used as plug Patient instructed in hygienic technic.

5 Patient warned to protect ear canal from water

6 Clean cavities heal within 8 12 weeks

PERITONSILLAR ABSCESS

(Incision and Drainage)

REQUIRED STUDIES

1 History—important to ascertain how long infection has been present.

2 Examination—supratonsillar and palatal swelling Palpation with finger reveals firmness with fluctuation

ELECTIVE STUDIES

1 Complete blood count and differential
2 Throat and abscess culture, sensitivity tests

DIFFERENTIAL CONSIDERATIONS

1 Peritonsillitis
2 Tumor

PREOPERATIVE TREATMENT AND ORDERS

1 Preoperative medication (see Chapter 3, p 35)
2 Local anesthesia (pontocaine® 1 or 2%) used in most cases Can use general but not desirable
3 Antibiotics

POSTOPERATIVE MANAGEMENT

1 Mouth wash as required
2 Antibiotics for 4 days at least
3 Tonsillectomy and adenoidectomy at later date for recurrent cases

RETROPHARYNGEAL ABSCESS

(Incision and Drainage)

REQUIRED STUDIES

1 History—pain, difficulty swallowing, septic course
2 Examination—retropharyngeal swelling
3 X-ray—lateral—Pancoast's technic to determine extent of swelling

ELECTIVE STUDIES

1 Complete blood count and differential
2 Throat culture and sensitivity tests

DIFFERENTIAL CONSIDERATIONS

1 Tumor
2. Retropharyngeal lymph node hypertrophy

PREOPERATIVE TREATMENT AND ORDERS

1 Routine preoperative medication (general anesthesia in younger children, local may be used in older children See Chapter 3, p 35)
2 Antibiotics

POSTOPERATIVE MANAGEMENT

1 Continue antibiotics
2 Aspirin and codeine for pain (see Chapter 4 p 58)
3 Warm gargle and mouth wash if child is old enough
4 Complications
   (a) Recurrence (reopen)
   (b) Extension into chest (drain)

HYPERTROPHIED AND DISEASED TONSILS AND ADENOIDS

(Tonsillectomy and Adenoidectomy)

REQUIRED STUDIES

1 Detailed history—in most cases the decision for tonsillectomy and adenoidectomy is based on the history
   (a) History of bleeding tendency should be investigated
2. Thorough examination
   (a) Ears—any middle ear disease or deafness of tubal origin?
   (b) Nose—obstructed by adenoids? Or by simple nasal congestion due to infection or allergies, or both? Or do all these exist? Is nose condition chronic or sub acute? Is septum straight? Is nose physiologically sound except for adenoidal obstruction?
   (c) Throat—size of tonsils means nothing unless unusually large and obstructive More important is the toneless inflamed soft, mushy red pillared tonsil
   (d) Cervical nodes—size—persistence
   (e) General—heart lungs abdomen
3 Laboratory work
   (a) Complete blood count
   (b) Urinalysis
   (c) Bleeding and coagulation times

ELECTIVE STUDIES

1 Nose and throat cultures
2 X ray of sinuses (in children sinus roentgenograms are not always reliable)

CONTRAINDICATIONS TO SURGERY

1 Blood dyscrasias
2 Acute infection
3 Poliomyelitis epidemic

INDICATIONS FOR SURGERY

The indications for tonsillectomy and adenoidectomy do not follow a pattern—each case is individual and the following list is only a guide

1 Repeated attacks of tonsillitis—3 or more a year—relief here by tonsillectomy and adenoidectomy is usually certain
2 Enlargement—obstruction of throat and nose interfering with normal function Large adenoids are the chief offenders
3 Ear diseases—as secretory or suppurative otitis media
4 Repeated attacks of peritonsillar abscess
5 Chronically diseased tonsils as a focus of infection in
   (a) Rheumatic heart disease
   (b) Acute nephritis
   (c) Asthma
   (d) Cervical adenitis
   (e) Malnutrition
   (f) Fever of undetermined origin
6 Halitosis—tonsils are commonly a cause of bad breath
7 Tuberculosis—tonsils and cervical lymph nodes
8 Diphtheria carriers
9 Inflammation of eyes

PREOPERATIVE TREATMENT AND ORDERS

1 High caloric diet day before operation Caloric intake next 24-36 hours is low
2 Antibiotics in cases of
   (a) Rheumatic fever or heart disease 24-48 hours before and 2 or 3 days after
   (b) Chronic or subacutely infected tonsils and adenoids
   (c) Nephritis
3 NBM 4 hours preoperatively Those patients being operated on late in day should have liquids for breakfast and water to 4 hours preoperatively

4 Preoperative medication for age and weight (see Chapter 3 p 35)
5 Proper psychic preparation Do not mislead or frighten patient Reassurance when indicated is important

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Airway must be kept clear at all times if patient has posterior plug for adenoidal bleeding this task is more difficult and extremely necessary
      i) Patient in prone position with head to one side and angled down tongue forward
      ii) Mechanical airway left in until not tolerated
   (b) Aspirin for pain (see Chapter 1 p 58)
   (c) Barbiturate for sedation (see Chapter 1 p 57)
   (d) Urge fluids when tolerated Important to keep hydrated and encourage use of throat muscles
   (e) Soft diet day of operation—ice cream jello milk egg nog
2 *Diet* following tonsillectomy and adenoidectomy
   (a) Well to remember the more the throat is used, the better it feels A child will eat what he likes and wishes No food hard or soft will harm the throat except highly seasoned foods and citrus juices They may be used but patient should be warned of pain
   (b) Chewing gum and hard candy help keep throat limber and lubricated
   (c) Aspirin 15 20 minutes before eating helps
3 *Activity*—gradual build up until normal activity resumed in 6-7 days
4 *Instructions* Parents should be carefully instructed in the above
5 *Complications*
   (a) Hemorrhage—early hemorrhage is controlled by adenoidal plug or suture in tonsil Late hemorrhage usually fifth to seventh day May come as late as the thirteenth day or later
      i) Parents should be told to contact doctor at first sign of bleeding
      ii) Arrest hemorrhage by

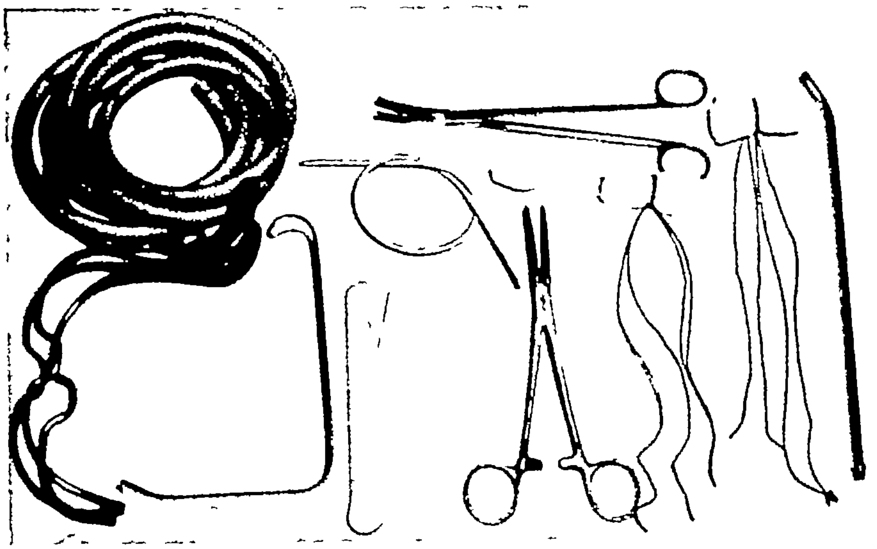

FIG 45—Setup used for inserting a gauze plug to control postoperative adenoidal bleeding

a) Removal of all clots
b) Pressure
c) Posterior plug for adenoidal hemorrhage
d) Sutures for tonsillar hemorrhage
e) Cautery—chemical or electric
f) Ligation of carotid—seldom necessary

(b) Lung abscess—by blood stream or aspiration (antibiotics early, thoracotomy late)
(c) Local infection or abscess (antibiotic will control condition)
(d) Atelectasis or bronchial obstruction by aspiration of foreign body (e g , piece of lymphoid tissue)
(e) Bronchitis (no treatment unless fever present, when antibiotics should be prescribed)
(f) Dehydration—poor fluid intake (Seldom need intravenous fluids)
(g) Vomiting 24-48 hours postoperatively Usually temporary and not serious
(h) Voice changes—usually temporary
(i) Pharyngeal and palatal cicatricial constriction from poor and too liberal surgery or from postoperative infection

(j) Loss of pillar anatomy—usually from carelessness in surgery

UPPER RESPIRATORY OBSTRUCTION

(TRACHEOTOMY)

REQUIRED STUDIES

1 History—to obtain idea of type of obstruction such as tumor paralysis tongue lesion or infection in epiglottis or hypopharynx
2 Examination
   (a) Indirect laryngoscopy where possible
   (b) Thorough throat and neck examination for extra laryngeal causes of obstruction
3 Evaluate general fatigue of patient degree of acidosis if present in acutely obstructive cases
4 Be sure that tracheotomy is indicated i e., patient will be relieved The signs of upper respiratory obstruction are
   (a) Retraction of supraclavicular and suprasternal areas intercostal spaces and sternum on inspiration—which is prolonged
   (b) Restlessness anxious look in eyes These patients are concentrating only on breathing and appear withdrawn from surroundings
5 Danger signs
   (a) Ashen gray color
   (b) Cyanosis
   (c) Acidosis.
   (d) Sleepy tired appearance These children wear themselves out and when exhausted there is no reserve energy
6 Decision as to when or if a tracheotomy is necessary
   (a) Slight encouragement and child takes part in and interest in surroundings This child should be watched
   (b) If the obstruction becomes progressively worse and child develops anxiety and becomes disinterested in surroundings tracheotomy is indicated
   (c) If condition is questionable, it is safer to perform tracheotomy

7 Sometimes condition is aggravated by laryngospasm Laryngospasm itself may be severe enough to indicate tracheotomy

ELECTIVE STUDIES
(If patient is not in acute stage of obstruction)

1 X-ray of chest
2 Lateral neck—for retropharyngeal abscess, epiglottic tumor, cyst of tongue, or foreign body
3 Culture of nose and throat

DIFFERENTIAL CONSIDERATIONS

1 Laryngotracheobronchitis, edema of larynx
2 Foreign body of larynx
3 Epiglottitis with or without abscess
4 Papilloma of larynx
5 Angioneurotic edema
6 Retropharyngeal abscess
7 Cyst, tumor, or aberrant thyroid at base of tongue
8 Infection
   (a) Diphtheria
   (b) Influenzal infection (H influenza seems to cause acute edema of larynx)
9 Paralysis of cords
10 Laryngospasm
11 Trauma
12 Nephrotic edema
13 Acute edema from ingestion of caustic or highly irritating chemicals
14 Congenital lesion
   (a) Stenosis
   (b) Webs
   (c) Laryngomalacia
   (d) Micrognathia
   (e) Choanal atresia
   (f) Laryngeal cartilage deformity

PREOPERATIVE TREATMENT AND ORDERS

1 Emergency cases—explain seriousness to parents
   (a) Oxygen under pressure—resuscitate until ready

(b) Emergency steps for relief if no tracheotomy equipment available
  i) Infants—insert #16 or #17 needle into trachea just below cricoid cartilage
  ii) Pass 3 or 3½ mm. bronchoscope under direct laryngoscopic view
  iii) Intubation
(c) No sedation
(d) No atropine or allied drugs Tenacious mucus obstructs larynx preoperatively and tube postoperatively
(e) Antibiotics

2 Urgent cases
  (a) No sedation
  (b) No atropine or allied drugs
  (c) Oxygen
  (d) In infants and children under 3 or 4 years of age, insert bronchoscope and perform tracheotomy without haste
  (e) Local anesthesia.
  (f) Intravenous fluids as indicated
  (g) Antibiotics

3 Elective cases—Same as urgent cases but endoscopy not necessary unless child under 3 years of age

POSTOPERATIVE MANAGEMENT

1 *Orders*
  (a) No atropine or allied drugs
  (b) Fluids for dehydration and acidosis
  (c) Diet as tolerated
  (d) Humidity—cold humidity best
  (e) Antibiotics.
  (f) Treat etiology

2 *Dressings*
  (a) Square gauze pad under and around tube is changed as required because of secretion Gauze used is close woven type that does not fray
  (b) Wound cleaned and antibiotic ointment applied three times daily and as required
  (c) Sutures out fourth or fifth day
  (d) Change tube third day and every other day as required

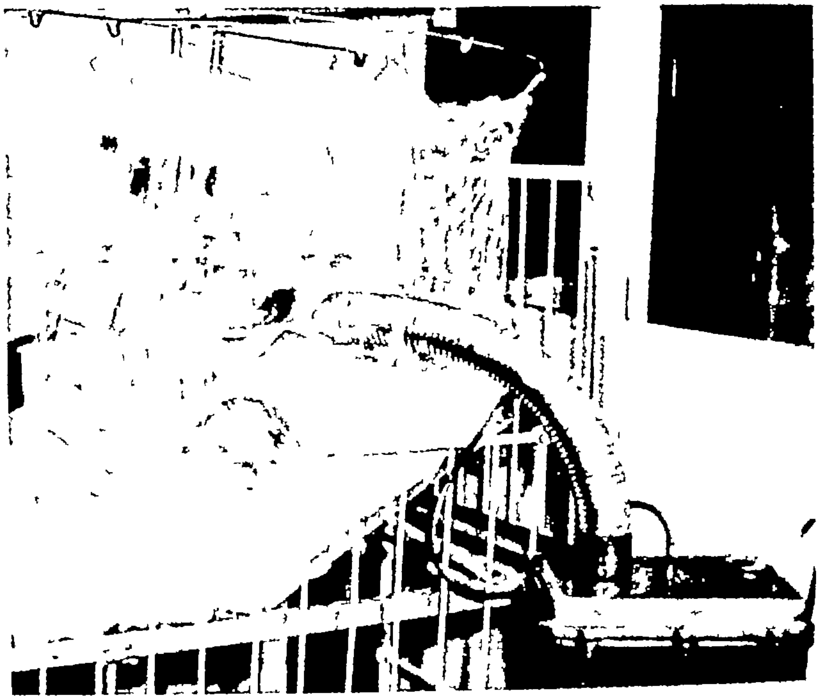

FIG 16—Mechanical means of producing 'cold steam' for laryngotracheobronchial conditions

3 *Special care* Twenty-four-hour constant nursing care, as long as laryngeal obstruction remains If tube becomes obstructed, patient in danger

4 *Studies* All diagnostic studies that were delayed because of emergency should be performed postoperatively when general condition permits

5 *Complications*

(a) Mediastinal emphysema due to closing wound too tightly around tube (Treatment—pack wound open, to permit spread)

(b) Pneumothorax (insert chest tube for suction)

(c) Pneumonia—not common

(d) Atelectasis—due to crusts and mucous plugs (remove by bronchoscopy and/or aspiration)

(e) Crusting of inner cannula—poor nursing care (cleanse cannula)

(f) Tube slipping out of trachea—tapes not tight enough or tube too short (reinsert)

(g) Tube failing to enter trachea when changed (reinsert)
(h) Infection of wound—poor nursing care (antibiotics indicated)
(i) Granuloma around incision (remove by bronchoscopy if intratracheal)
(j) Laryngeal stenosis—tracheotomy too high—cricothyroid membrane involved
(k) Tracheal fistula (plastic repair)

6 *Decannulation*—many methods of testing for adequate airway All are useful Remember to replace with small cannula if one used is too large to allow air around it
(a) Corking—partial corking—½ or ¾ corks to full cork used then removal of tube
(b) Block tube and observe patient s respiration if not distressed keep blocked but keep extremely close watch on patient If breathing satisfactory for 12 hours remove tube
(c) In some cases laryngoscopy may be necessary to determine why tube cannot be removed
  i) Chronic edema
  ii) Granuloma
  iii) Cicatricial stenosis
(d) Remember psychic effect especially if tube present for any length of time
  i) Do not tell patient tube is going to be removed
  ii) If child is older and afraid to have tube removed this should be done while asleep and/or under anesthesia

CHOANAL ATRESIA

(RESECTION OF ATRESIA)

REQUIRED STUDIES

1 History
(a) Difficult respirations
(b) Cyanosis

2 Physical findings—Obstruction of nose by probing or insufflation of air

3 Radiopaque material retained in nostril

FIG. 17.—*A*, polyethylene tubes used as outer and inner cannulas for keeping choanae open after surgery. *B*, tubes in place in patient.

ELECTIVE STUDIES

None

DIFFERENTIAL CONSIDERATIONS

None

PREOPERATIVE TREATMENT AND ORDERS

Degree of obstruction indicates treatment. If airway not adequate or absent, the procedure chosen is transpalatal resection of atresia using mastoid drill technic. Unilateral cases done later at 2-3 years or older.

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Careful watch of vital signs
   (b) O with humidity
   (c) Liquid diet for first week Then soft solid diet
   (d) Arm restraints
2 *Dressings*
   (a) Polyethylene cannulas used to keep operative site open Inner cannulas made one size smaller Outer cannulas not changed for first week Inner cannula changed as required
   (b) Outer cannula changed as required after first week Removed completely fourteenth to twenty first postoperative day

FOREIGN BODY OF TRACHEA AND LUNG

(BRONCHOSCOPY)

REQUIRED STUDIES

1 History—important to obtain detailed history such as time, date of accident object choked on May be acute or chronic condition
   (a) Choking and coughing—aspiration
   (b) Cough—violent if foreign body moving about productive, nonproductive purulent or non purulent (If foreign body lodged and not obstructing the patient is asymptomatic.)
   (c) Wheezing
   (d) Dyspnea
   (e) Cyanosis
2 Physical examination with complete chest examination Findings dependent on location of foreign body and degree of obstruction and duration of presence.
   (a) Completely obstructed bronchi
      i) Signs of atelectasis of part or whole lung
      ii) Fluid collection in lung distal to foreign body resembles emphysema
   (b) Partial obstruction with ball valve action which gives
      i) Atelectasis

ii) Emphysema—air retained in lung Ball-valve action
iii) Combination of both—one or multiple foreign bodies
(c) Toxic signs—foreign bodies of vegetable and chemical nature
i) Fever, râles, toxemia, increased respiration and pulse Often mistakenly diagnosed as pneumonia
3 X-ray nasopharynx to pelvis

DIFFERENTIAL CONSIDERATIONS

1. Pneumonia
2 Tumor—rare in children
3 Tuberculosis
4 Diphtheria
5 Pleural effusion
6 Empyema

PREOPERATIVE TREATMENT AND ORDERS

1 Emergency cases—no delay in treatment Bronchoscopy or tracheotomy or both as indicated by presence of laryngeal edema or foreign body obstruction in larynx
2 No sedation or atropine-like drugs used pre or postoperatively
(a) Tenacious mucus obstructs
(b) Sedation dangerous with dyspnea
3 Anesthesia considerations
(a) Ether is safe in cases where there is no dyspnea or respiratory distress
(b) Severe cases of dyspnea—no anesthesia Some local may be used—pontocaine 0 5%
4 Oxygen for dyspneic cases
5 Warn parents of danger and possibility of tracheotomy
6 Antibiotics—when indicated
(a) Long-standing cases
(b) Infection
(c) Vegetable foreign body or chem
7 Wait, if no emergency, until child feeding for 1 6 hours
8 Remove foreign body as soon as emergency

POSTOPERATIVE MANAGEMENT

1 Watch closely for laryngeal obstruction This should not happen if edema is not present prior to endoscopy and if scope of correct size is used and care taken
   (a) If obstruction occurs place in humidity
   (b) Tracheotomy if needed
   (c) Danger is in first 24 36 hours
2 No sedation or atropine
3 Humidity and oxygen in cases where much reaction or infection exists
4 Aspirate by laryngoscopy if necessary for tenacious mucus
5 Diet as tolerated
6 Fluids by vein

BRONCHOSCOPY

SEE FOREIGN BODY OF TRACHEA AND LUNG p 307

ESOPHAGOSCOPY

PREOPERATIVE TREATMENT AND ORDERS

Esophagoscopy in children is best performed under general anesthesia. Newborn infants usually need nothing
1 Liquids by vein in cases of dehydration resulting from obstruction
2 In some cases, nothing by mouth until diagnosis made Then diet as indicated NBM 4 hours preoperatively
3 Antibiotics in esophagitis, long standing foreign bodies sharp foreign bodies and suspected cases of perforation
4 Preoperative medication (see Chapter 3 p 35)
5 In suspected cases of perforation x ray and preparation for drainage indicated, if necessary

POSTOPERATIVE MANAGEMENT

1 *Orders*
   (a) Diet contingent on condition of esophagus and disease
      i) Uncomplicated—general diet as tolerated
      ii) Esophagitis or ulceration—no perforation—liquid to soft diet for 4 5 days
   (b) Antibiotics in infectious cases esophagitis ulceration.

COMPLICATIONS

Perforation (drain mediastinum surgically, antibiotics, nothing by mouth, tube feeding or gastrostomy)

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CHAPTER 15

Ophthalmic

MURRAY F McCASLIN and LOIS A LLOYD

PEDIATRIC OPHTHALMIC SURGERY differs from general ophthalmic surgery only in the age of the patient and in the frequency with which congenital defects must be treated

Some comments regarding the diagnosis differential diagnosis pre and postoperative care and the common procedures in pediatric ophthalmic surgery will be made

The considerations mentioned in the General Postoperative section of this book apply to patients undergoing ocular as well as general surgery They will not be discussed further in this chapter

The conditions requiring surgical correction and other problems commonly encountered in dealing with children s eyes are

Strabismus, ptosis nasolacrimal duct obstructions cataracts glaucoma, intraocular tumors orbital tumors injuries chalazions and enucleations

STRABISMUS

REQUIRED STUDIES

1 History—age at onset gives clue as to origin such as paralytic, anatomic, or accommodative
2 Vision—this can be done in the very young by objective means other than visual charts

3 Fundus examination—to exclude anatomic or pathologic conditions
4 Fusion status and retinal correspondence
5 Refraction under atropine cycloplegia
6 Evaluation of glasses in accommodative esotropia or partially accommodative esotropia
7 Evaluation of orthoptic exercises in suitable cases
8 Occlusion—constant and total when indicated
9 Repeated examinations to determine the exact nature of the muscle defect and its constancy

INDICATIONS FOR SURGERY

1 The mechanical and paralytic squint should be operated on early—but conservatively
2 Correct the deviation present with the dominant eye fixing, regardless of whether it is primary or secondary deviation, remembering that the same operation will correct more secondary than primary deviation

CONTRAINDICATIONS FOR SURGERY

1 Accommodative esotropia
2 Abnormal retinal correspondence precludes a favorable result in the majority of cases

PREOPERATIVE TREATMENT

1 One to 3 years of age
   (a) Barbiturates or codeine 1 hour preoperatively (Chapter 4, pp 57-58)
   (b) Atropine (Young's rule)
   (c) Ether anesthesia
2 Three to 12 years of age
   (a) Cleansing enema night before operation
   (b) Atropine (Young's rule)
   (c) Avertin®—to reduce psychic trauma Many eye conditions require multiple examinations or operations
   (d) Ether anesthesia

POSTOPERATIVE MANAGEMENT

1 Monocular or binocular dressings, depending on whether one or both eyes operated on.

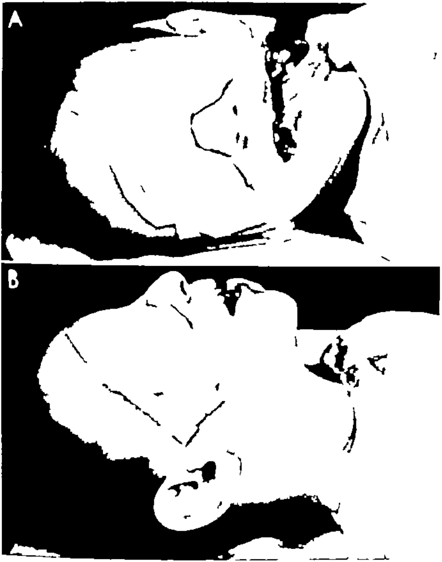

FIG 48.—*A* bilateral eye dressings frontal view *B* bilateral eye dressings, lateral view

2 Daily dressings—continued as long as reaction indicates
3 Compresses—depending on reaction
4 Allow patient up as soon as one eye is uncovered
5 Glasses when indicated
6 Orthoptic exercises when indicated

COMPLICATIONS

1 Undercorrection Keep both eyes atropinized for 3-4 weeks
2 Overcorrection
   (a) If hyperopic, reduce power of glasses
   (b) Start exercises early
3 Tissue reaction to sutures
   (a) Compresses
   (b) Cortisone locally
   (c) Corticosteroids systemically if severe

PTOSIS

REQUIRED STUDIES

1 History—age at onset Congenital ptosis favorable for surgery, as is that ptosis associated with "hereditary progressive nuclear ophthalmoplegia"
2 Condition of superior rectus muscle determines type of surgical procedure
3 General physical status of patient (see Contraindications)

CONTRAINDICATIONS FOR SURGERY

1. Parasitic disease
2. Myasthenia gravis
3 Third cranial nerve lesions, aneurysms, brain tumors

INDICATIONS FOR SURGERY

1 To be done early when ptosis is complete, otherwise amblyopia will develop
2. Can be deferred when pupillary opening is not occluded In these cases it is an elective operation for cosmetic purposes

PREOPERATIVE TREATMENT

See Strabismus (p 312)

POSTOPERATIVE MANAGEMENT

1 Daily dressings
2 Out of bed day after surgery
3 Compresses (warm) after third day if reaction indicates
4 Corticosteroid therapy systemically if reaction is severe
5 Hospitalization until sutures are removed

COMPLICATIONS

1 Undercorrection—reoperate
2 Overcorrection—protect cornea with antibiotic ointment until surgical repair can be made

NASOLACRIMAL DUCT OBSTRUCTIONS

REQUIRED STUDIES

1 History—age at onset
2 Patency of puncta canaliculi and nasolacrimal duct
3 Radiographic studies may be made but usually are not satisfactory

PREOPERATIVE TREATMENT

1 For irrigation or probing no preoperative treatment is necessary in the very young Children over 1 year of age should be given atropine (Young s rule) and vinethene® Avertin® and ether anesthetic for surgery lasting more than 5 minutes
2. For nasolacrimal surgery—dacryocystorhinostomy atropine and ether up to 3 years of age Atropine avertin® and ether over 3 years of age

POSTOPERATIVE MANAGEMENT

1 Daily dressings for dacryocystorhinostomy patients
2 Skin sutures out by third day to minimize scar from sutures
3 Nasolacrimal irrigations on fifth postoperative day and 1 week later

CATARACTS

REQUIRED STUDIES

1 Family history to determine heredity factor Health of mother in first trimester

2 Location of cataract within the lens
3 General condition of patient

INDICATIONS FOR SURGERY

1 Small anterior polar cataracts do not produce much if any visual disturbance, others require surgery if vision is subnormal
2 A monocular cataract is operated on, as only in this way can vision in the eye be improved

PREOPERATIVE TREATMENT

See Strabismus (p 312)

POSTOPERATIVE MANAGEMENT

1 Cuffs to be worn by all patients undergoing intraocular surgery The nurse who returns the patient to bed stays with the child until this is completed
2 Daily dressings, using atropine to keep the pupil well dilated
3 Out of bed on second postoperative day following discission Out of bed on third day following linear extraction

COMPLICATIONS

1 Iritis
 (a) Antibiotics by mouth and intramuscularly.
 (b) Cortisone locally
 (c) Atropine locally
 (d) Repeat physical examination for detection of foci of infection such as head cold, tonsillitis, gingival and urinary infections
2 Glaucoma
 (a) If only a discission has been done, the lens material may have filled the angle and requires a linear extraction (miotic—locally)
 (b) If vitreous has filled the angle, the aqueous may be drained through a paracentesis and air injected to displace the vitreous (Diamox®—short interval to reduce aqueous formation)

FIG. 49—Taking the intraocular tension in a suspected glaucoma case

GLAUCOMA

REQUIRED STUDIES

1. History—age at onset.
   (a) Primary type—congenital
   (b) Secondary type—Complicating trauma.
2. Tension—when general anesthetic has to be given to check tension, ether is the anesthetic of choice because the depth of anesthesia has to be carried into the second plane of the third stage of anesthesia If not carried into this plane of anesthesia, a true picture of the intraocular tension is not obtained
3. Miotics—an adequate trial of various miotics should be employed before advising surgery

OTHER CONSIDERATIONS

Patient should be informed that more than one operation is usual rather than exceptional

PREOPERATIVE TREATMENT
See Strabismus (p 312)

POSTOPERATIVE MANAGEMENT

1 Cuffs indicated in patients undergoing intraocular surgery
2 Daily dressings
3 Miotics if indicated
4 Out of bed second day after goniotomy
5 Out of bed third to fourth day in other operations

COMPLICATIONS

If tension is not controlled, further surgery is indicated

INTRAOCULAR TUMORS

REQUIRED STUDIES

1 History—age at onset What attracted parent's attention to condition?
2 Location of tumor—fundus examination
3 Transillumination (Wheeler sign if old enough)
4 X-ray studies
5 Associated neurologic conditions
6 Radioactive studies—not always reliable

DIFFERENTIAL CONSIDERATIONS

1 Retinal separation
2 Subretinal hemorrhage with retinal separation
3 Retrolental fibroplasia
4 Chorioretinitis

PREOPERATIVE TREATMENT

1 One to 3 years of age
   (a) Barbiturates or codeine 1 hour preoperatively (Chapter 4, pp 57-58)
   (b) Atropine (Young's rule)
   (c) Ether anesthesia
2 Three to 12 years of age
   (a) Cleansing enema night before operation
   (b) Atropine (Young's rule)

(c) Avertin[?] to reduce psychic trauma. Many eye conditions require multiple examinations or operative procedures.
(d) Ether anesthesia

STOPERATIVE MANAGEMENT

1. Pressure bandage following enucleation
2. Daily dressing with pressure bandage
3. Compresses three times daily and ointment when indicated
4. Insertion of prosthesis 1 or 2 weeks postoperatively or as soon as the edema has subsided
5. Radiation therapy when indicated

OMPLICATIONS

Local or metastatic recurrences. Further surgery indicated.

ORBITAL TUMORS

EQUIRED STUDIES

1. History
2. Special examination of the part (detailed)
3. General examination with complete laboratory work up

TYPES OF TUMORS

1. Orbital tumors
   (a) *Benign*
      i) Hemangioma. The angioblastic and capillary types occur primarily in childhood
      ii) Eosinophilic granuloma
      iii) Lipoma
      iv) Dermoids
   (b) *Malignant*
      i) Primary lacrimal gland tumors—carcinoma and fibrosarcoma
      ii) Metastatic
         a) Retinoblastomas extending through the sclera may invade orbit
         b) Medulloblastoma—This is bilateral, secondary to adrenal tumors
         c) Lymphomas and leukemic infiltrations in the orbits may be evidence of general \[illegible\]

d) Carcinoma may be secondary to nasopharyngeal malignancy or carcinoma in the kidney

2 Optic nerve tumors

(a) *Intrinsic*

i) Glioma may be associated with Recklinghausen's disease It must be carefully considered when there is unilateral loss of vision associated with optic atrophy Seventy-five per cent of such tumors occur in the first decade of life

(b) *Extrinsic*

i) Meningiomas are rare in childhood

ii) Neurofibroma—Penfield and Hortega believe that the Schwann cells of the peripheral nerves and the oligodendroglial cells of the optic nerve are similar

iii) Melanomas These are rare and may occur from the pigmented cells in the lamina cribrosa

DIFFERENTIAL CONSIDERATIONS

1 Congenital

(a) Dermoids (characteristically they occur in the upper outer quadrant)

(b) Meningocele (characteristically they occur in the nasal portion of the orbit)

(c) Bony abnormalities (exostosis, craniostenosis, craniofacial dysostosis)

2 Acquired

(a) Inflammations

i) Orbital cellulitis secondary to sinusitis

ii) Mucocele—there may be a history of chronic sinusitis and characteristic x-ray changes

iii) Pseudotumor—granulation tissue may result from old infection

iv) Parasitic disease—trichinosis is accompanied by high eosinophilia The diagnosis is made by muscle biopsy

(b) Allergy—angioneurotic edema of orbital tissues may occur

(c) Metabolic disorders

i) Hand Schuller Christian disease diagnosed by the

pathology in which large xanthomatous cells occur in the biopsy
ii) Hyperthyroidism or imbalance of anterior pituitary hormones may cause exophthalmos
iii) Trauma may result in
a) Retrobulbar hemorrhage
b) Emphysema from a fracture through a sinus
c) Pulsating arteriovenous communication

PREOPERATIVE TREATMENT

See Strabismus (p 312)

POSTOPERATIVE MANAGEMENT

1 Dictated primarily by type of operation
2 Daily dressing
3 Ambulation as soon as possible

COMPLICATIONS

Local recurrences Further surgery indicated

INJURIES

REQUIRED STUDIES

1 History—valuable when reliable—to ascertain traumatizing agent.
2 Visual acuity—necessary in medicolegal cases
3 Examination under anesthesia if full co-operation is lacking utilizing all means available (fluorescein staining to detect superficial corneal damage)
4 Medical investigation—indicated in recurrent hemorrhages
5 X rays localizing all perforating lesions when indicated

COMPLICATIONS

1 Iritis and/or extraocular infections conjunctivitis keratitis uveitis panophthalmitis
2 Traumatic cataract from contusion or penetrating injuries
3 Glaucoma—secondary
4 Retinal separation from contusion and retinal tears caused by penetrating injuries
5 Subretinal hemorrhages

6 Commotio retinae from contusion injuries
7 Siderosis or chalcosis bulbi—iron or copper deposits in ectodermal structures
8 Sympathetic ophthalmia

PREOPERATIVE TREATMENT

See Strabismus (p 312)

POSTOPERATIVE MANAGEMENT

Dictated by complications

CHALAZIONS

REQUIRED STUDIES

1 None—particularly for single infection
2 Physical examination to evaluate general health

PREOPERATIVE TREATMENT

Conservative
 1 Vaccines—specific autogenous or Staphylococcus toxoid for recurrent infection

Surgical
 See Strabismus (p 312).

POSTOPERATIVE MANAGEMENT

1 Patch for 12 hours
2 Hot compresses three times daily for 1 or 2 days if necessary to control local reaction
3 Local medication Sulfacetimide sol 30% three times daily for 1 week

ENUCLEATIONS

Wright reports the conditions in which enucleations are indicated These include

1 A blind, painful eye
2 Injured eyes with complete destruction and no hope of recovering vision
3 Suspected malignant tumor where there is no evidence of metastasis Retinoblastoma is the most common malignant tumor for which enucleation is done

4 Shrunken, unsightly eyes

There are other conditions in which only individual judgment and skill can decide whether or not enucleation is indicated These include

1 Postoperative complications associated with pain and poor vision and iridocyclitis
2 The occasional patient with a perforated eye in which the vision is still useful

In such instances helpful considerations favoring enucleation include

(a) When the fellow eye is irritable but otherwise clinically normal
(b) When keratic precipitates are the only finding in the other eye
(c) When the wound has retracted the eye is soft and tender and the vision is only fair

Considerations which do not favor enucleation include

(a) When the wound heals well and the tension is not elevated
(b) When the injured eye has vision after the fellow eye has become inflamed (occasionally the injured eye may be the only useful eye once sympathetic ophthalmia has developed)
(c) When both eyes are inflamed
(d) When *panophthalmitis has developed in the opposite eye*

COMPLICATIONS

1 Extrusion of the implant occurs when the implant used was too large or when infection has broken down the wound.
2 Loss of the fornices may result from removal of too much conjunctiva
3 Malignancy may necessitate postoperative radiotherapy and plastic surgery

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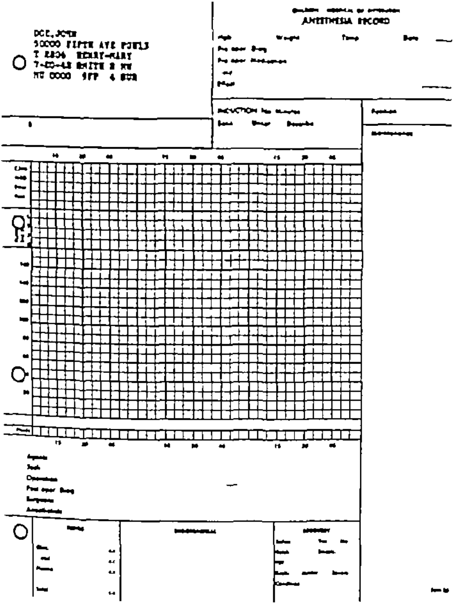
APPENDIX A

FORMS USED IN PRE AND POSTOPERATIVE CARE



PYLORIC STENOSIS REGIMEN*

NAME

No

DATE

Time		Feedings	Remarks
1	at	Give 30 minims glucose water	
2—30 min later	at	Give 1 dr glucose water	
3—30 min later	at	Give 2 dr glucose water	
4—30 min later	at	Give 2 dr glucose water	
5—30 min later	at	Give 2 dr glucose water and 1 dr milk	
6—2 hrs later	at	Give 3 dr. glucose water	
7—1½ hrs later	at	Give 2 dr glucose water and 2 dr milk	
8—1½ hrs later	at	Give 4 dr glucose water	
9—1½ hrs later	at	Give 2 dr glucose water and 3 dr milk	
10—1½ hrs later	at	Give 5 dr glucose water	
11—1½ hrs later	at	Give 1 dr glucose water and 5 dr milk	
12—1½ hrs later	at	Give 6 dr glucose water	
13—1½ hrs later	at	Give 1 dr glucose water and 6 dr milk	
14—1½ hrs later	at	Give 7 dr glucose water	
15—1½ hrs later	at	Give 1 dr glucose water and 7 dr milk	
16—1½ hrs later	at	Give 1 oz glucose water	
17—1½ hrs later	at	Give 1 dr glucose water and 1 oz milk	
18—1½ hrs later	at	Give 9 dr glucose water	
19—2 hrs later	at	Give 1 dr. glucose water and 9 dr milk	

Then give 1 oz skim milk every (3) hours plus glucose water between feedings *Not to exceed 1 oz*

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* From a form used at the Children's Hospital of Philadelphia

APPENDIX B

COMPUTATION FOR TREATMENT OF DEHYDRATION AND ACIDOSIS

I. Treat shock if present.
   1 50% glucose 10-20 cc IV stat or
   2. Plasma 10 cc/kg IV stat

II. Replacement of Na and Cl deficit

1 *Determination of hydrated weight*

If dehydration, weight loss
   (a) Severe 10%
   (b) Moderate 5%

On admission patient weighs 4 kg
∴ Dehydrated weight = 4 kg
Hydrated weight = X
X — 0 1 X = 4 kg.
   0 9 X = 4 kg
   X = 4 44 kg.
∴ Hydrated weight = 4 44 kg.
   or patient lost 0 44 kg

2 *Determination of hydrated ECF (extracellular fluid) volume*

Assume 25% of hydrated weight = hydrated extracellular fluid (ECF)
25% of 4 4 kg. = 1 1 kg
∴ Hydrated ECF = 1 1 kg

3 *Determination of hydrated total Na and Cl*

Normal values
   Na = 140 mEq/L.
   Cl = 100 mEq/L.
∴ Hydrated total Na = 140 mEq/L. × 1 1 = 154 mEq
∴ Hydrated total Cl = 100 mEq/L. × 1 1 = 110 mEq

4 *Determination of dehydrated ECF*

If hydrated ECF = 1 1 kg. and by step (1) patient lost 0 44 kg.

$$\begin{array}{r} 1\ 10 \\ 0\ 44 \\ \hline 0\ 66 \end{array}$$

∴ Dehydrated ECF 0 66 kg

5 *Determination of dehydrated total Na and Cl*

Laboratory determinations on admission

CO_2 = 15 mEq /L

Cl = 120 mEq /L

Assume CO_2 + Cl + 15 = Na approx

thus 15 + 120 + 15 = 150

thus Dehydrated Na = 150 mEq /L

Dehydrated Cl = 120 mEq /L

thus Dehydrated total Na = 150 mEq /L × 0 66 L = 99 mEq

Dehydrated total Cl = 120 mEq /L × 0 66 L = 79 mEq

6 *Determination of Na and Cl deficit*

	Na	Cl
Hydrated	154	110
Dehydrated	99	79
Deficit	55	31

7 *Replacement of Na and Cl deficit*

M/6 Na lactate = 150 mEq Na/L

Normal NaCl = 150 mEq Na/L

150 mEq Cl/L

Thus to give 31 mEq Cl and 31 mEq Na

$$\frac{150 \text{ mEq}}{1000 \text{ cc}} = \frac{31 \text{ mEq}}{X}$$

X = 200 cc

200 cc NaCl = 31 mEq Na and 31 mEq Cl

Patient still needs (55-31) or 24 mEq Na

Thus to give 24 mEq Na

$$\frac{150 \text{ mEq}}{1000 \text{ cc}} = \frac{24 \text{ mEq}}{X}$$

X = 180 cc M/6 Na lactate

Finally· 1 180 cc M/6 Na lactate

2 200 cc NaCl

380 cc

For treatment give 200 cc /kg total fluids in first 24 hours or 200 cc /kg = 800 cc

800 cc

−380 cc

3 420 cc given as 5% glucose

APPENDIX C

DRUG DOSAGES

Albumin (IV) (concentrated, salt poor)—1 2 cc./lb
Antibiotics (see table on pages 61 and 62)
Aspirin (see page 58)
Calcium gluconate (IV)—10 cc. (10% solution)
Codeine (see page 58)
Cortisone (ophthalmic)—0 5 2 5% drops or ointment
Demerol® (see page 58)
Diamox® (PO)—250 mg. 1-4/day
Dilantin® (PO)—0.75 1 5 gr./day
Eserine (ophthalmic)—0 25-0 5% drops
Floropryl® (ophthalmic)—0.1% drops
Furmethide® (PO)—5 mg
Kaopectate® and neomycin mixture—1 teaspoonful every 4 6 hours
Morphine (see page 58)
Neomycin (bowel preparation only) (PO)—7 5 15 mg./kg./day in divided doses
Pancreatin—0 5 G/bottle (PO) or 1 0 G before meals (PO)
Paregoric (PO)—0 5 cc. 1 0 cc. every 3-4 hours (patient over 5 years of age)
Pilocarpine (ophthalmic)—1 2% drops
Phenobarbital (see page 57)
Pitressin®—0 2 1 0 cc. IM as needed
Sodium salicylate (IV)—60 mg (1 gr.)/yr of age in 25 cc. saline
Sulfasuxidine® (bowel preparation only)—0 5 G/kg./day in 3 doses
Tridione® (under 3 yrs.) (PO)—150 mg two or three times daily
(over 3 yrs.) (PO)—300 mg two or three times daily
Viokase—⅛ teaspoonful/bottle or ¼ teaspoonful before meals

APPENDIX F

NORMAL SPINAL FLUID CONSTITUENCY

Pressure	70-200 mm. water
Protein	less than 40 mg %
Chloride	123-130 mEq./L.
Sugar	40-60 mg %

APPENDIX D

CONSTITUENCY OF ELECTROLYTE SOLUTIONS USED IN PEDIATRIC SURGERY*

Normal saline
  Na^+—150 mEq /L
  Cl^-—150 mEq /L
3% sodium chloride solution
  Na^+ -—500 mEq /L
  Cl^-—500 mEq /L
⅙ molar sodium lactate
  Na+—160 mEq /L
7 5% sodium bicarbonate
  Na+—893 mEq /L
2% ammonium chloride
  Cl+—374 mEq /L

* From Elkinton, J R , and Danowski, T S *The Body Fluids Basic Physiology and Practical Therapeutics* (Baltimore Williams & Wilkins Company, 1955)

APPENDIX E

NORMAL BLOOD CHEMISTRIES IN SERUM

NPN	25-38 mg %
Blood sugar	64-100 mg %
CO_2	18-25 mEq /L (43-55 vol %)
Chloride	97-103 mEq /L (345-366 mg %)
Cholesterol	150-300 mg %
Total protein	6 5-7 5 Gm %
Albumin	4 5-5 5 Gm %
Globulin	1 7-3 0 Gm %
Calcium	9-11 5 mg % (4 5-5 7 mEq /L)
Phosphorus	3-6 mg %
Potassium	3 5-5 3 mEq /L
Sodium	137-144 mEq /L

APPENDIX F

NORMAL SPINAL FLUID CONSTITUENCY

Pressure	70-200 mm. water
Protein	less than 40 mg %
Chloride	123-130 mEq/L
Sugar	40-60 mg %

APPENDIX G

BLOOD ERYTHROCYTE, HEMATOCRIT, HEMOGLOBIN AND THROMBOCYTE VALUES, BIRTH TO MATURITY MAN[4]

Age	Erythrocyte Count		Reticulocyte Count		Eryth Packed Volume (Hematocrit)	Erythrocyte Volume[1]	Hemoglobin Concentration		Eryth Hemoglobin Content	Eryth Hemoglobin Concentration[3]
	millions/mm³		% of total erythrocytes		ml /100 ml blood	m³	g /100 ml blood		mm g	g /100 ml erythrocytes
	Value[5]	Range[6]	Value[5]	Range[6]	Value[5]	Value[5]	Value[5]	Range[6]	Value[5]	Value[5]
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
At birth[7]	5 7	4 8-7 1[c]	4 35	2 50 6 50[c]	56 6	106	21 5	18 0 27 0[c]	38	38 0
First day	5 6	4 7 7 0[c]			56 1	106	21 2	17 7-26 5[c]	38	37 8
End 1st wk	5 3	4 5 6 4[c]	1 12	0 10 4 50[c]	52 7	101	19 6	16 2-25 5[c]	37	37 2
End 2d wk	5 1	4 3 6 0[c]	0 67	0 20-1 50[c]	49 6	96	18 0	14 5 24 2[c]	35	36 3
End 3d wk	4 9	4 1 6 0[c]	0 63	0 20 1 30[c]	46 6	93	16 6	13 2-23 0[c]	34	35 6
End 4th wk	4 7	3 9 5 9[c]	0 73	0 10-1 00[c]	44 6	91	15 6	12 0-21 8[c]	33	35 0
End 2d mo	4 5	3 8 5 8[c]	1 20	0 50 3 10[c]	38 9	85	13 3	10 8 18 0[c]	30	34 2
End 4th mo	4 5	3 8 5 3[c]	1 66	0 90 2 94[c]	36 5	79	12 4	10 2-15 0[c]	27	34 0
End 6th mo	4 6	3 9 5 3[c]	1 38	0 72 2 30[c]	36 2	78	12 3	10 0 15 0[c]	27	34 0
End 8th mo	4 6	4 0 5 4[c]	1 12	0 65-1 90[c]	35 8	77	12 1	9 8-15 0[c]	26	33 8
End 10th mo	4 6	4 0-5 5[c]	0 97	0 62-1 80[c]	35 5	77	11 9	8 4-14 9[c]	26	33 5
End 12th mo	4 6	4 0 5 5[c]	0 90	0 60 1 70[c]	35 2	77	11 6	9 0 14 6[c]	25	33 0
End 2d yr	4 7	3 8-5 4[c]			35 5	78	11 7	9 2 15 5[c]	25	33 0
End 4th yr	4 7	3 8 5 4[c]			37 1	80	12 6	9 6 15 5[c]	27	34 0
End 6th yr	4 7	3 8 5 4[c]			37 9	80	12 7	10 0-15 5[c]	27	33 5
End 8th yr	4 7	3 8 5 4[c]			38 9	80	12 9	10 3-15 5[c]	27	33 2
End 10th yr	4 8	3 8 5 4[c]			39 0	80	13 0	10 7-15 5	27	33 3
End 12th yr	4 8	3 8 5 4[c]			39 6	81	13 4	11 0 16 5[c]	28	33 8
14 yrs & over										
Males	5 4	4 6 6 2[b]			47[8, 9, 10]	87[9, 10]	15 8	14 0 18 0[b]	29[10]	33 5[9]
Females	4 8	4 2 5 4[b]			42[8, 9, 10]	87[9, 10]	13 9	11 5 16 0[b]	29[10]	33 5[9]
M A I [illegible]	5 1	4 2 6 2[b]	1 5	0 5 3 8	41 5[8, 9]	87[9]	14 9		29[10]	33 5[9, 10]

Mea Corpuscular Vol m (MCV) Mea Corpuscula Hemoglobl (MCH) M C rpuscula Hemoglobin Concentration (MCHC) in % Cutaneou blood. Di ect method f Wood, V ogel nd F m kne ept 23 I M-di ect method of Rees Ecker
[a] Smoothed means from plotted curves. Smoothed sample ranges from plotted curves (e cept noted) If co d clamped fter pla cental separation, average 560 000 more rythrocytes per mm and 2 6 g/100 ml more hemoglobl dur g the first week of life than f cord clamped immediately after birth. Also in newborn heel blood (= pillary) higher in erythrocytes and hemoglobin than blood from superior sagittal sinus. Centrif ged at 2000 g (3000 rpm) or o er f r 10 min., after ttaini g constant packed cell volum Heparin or other isotonic anticoagula t. [b] Estimate "b" of 95% ra ge: 40-54 for 20F; 3 -47 f r 21I 0 94 for 20C; 74-99 for 21C 25-34 for 20J; 24-33 for 21J 23 35 for 22J; 30-40 for 22K.
From A.A.F Tech ical Report No 6039 T ble 39.

APPENDIX H

NORMAL LIVER FUNCTION STUDIES

Bilirubin
  Total—Less than 1 0 mg %
  Free—Less than 0 16 mg %
BSP—10% retention or less in 30 minutes
Alkaline phosphatase—5 0-12 0 Bodansky units
Thymol turbidity—0
Thymol flocculation—0
Cephalin flocculation—0—24 and 48 hours
Prothrombin time (Quick) 12-15 secs. (100% as compared to con
  trol)

Index

W